CENTRE OF INFORMATION TECHNOLOGY

INFO901/2101 Research Project Report

The factors that influence IT professionals to use data visualization tools in China and New Zealand

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Statement of authenticity

I certify that this research is my work, except for the reference section, which has been marked. I have documented all methods, data and processes truthfully, not manipulate any data. I understand that all significant misrepresentations may result in expulsion from the Waikato Institute of Technology (WINTEC).

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Abstract

With the popularity of the big data concept and the explosive growth of data, more and more companies and individuals are no longer satisfied with the routine operation of excel and start to look for modern data visualization tools suitable for their purpose. Therefore, it is necessary to evaluate visualization software to prove its effectiveness, efficiency, usability, and utility, to help users find an appropriate visualization tool. This research aims to identify the factors influencing IT professionals to choose data visualization tools in China and New Zealand. The research project adopts a quantitative approach to analyze the factors such as user interface, data source connection, help documentation, pricing packages, and functionality updates. The researcher creates an online survey with 24 questions, and 388 valid responses have been collected through LinkedIn (international version). The researcher applies descriptive analysis, Chi-Square test and three-way ANOVA to analyze the results. The top three popular data visualization software that IT professional used are Microsoft Power BI, Excel and Tableau. The most critical factor that influences IT professionals to choose data visualization tools is the user interface flexibility. The results suggest the design of data visualization tools and what to consider when selecting the right data visualization tool.

Key words: Data Visualization Tools, Data Source Connection, Evaluation Criteria, Functionality Updates, Help Documentation, Microsoft Power BI, Pricing Packages, User Interface

Table of Contents

List of Tables

List of Figures

1. Introduction

Data growth has increased dramatically today, and a large amount of data is generated from different fields. With explosive data growth and complexity, data visualization software has become very important for business and individuals in the decision-making process. According to Reina, Childs, Matković, Bühler, Waldner, Pugmire, ... & Krone (2020), the visualization technique is widely accepted for analyzing a wide range of data types and datasets.

1.1 Background Information

With the advent of various data visualization tools, choosing an appropriate visualization tool to provide the information needed for work and personal use can be challenging. Great data visualization tools can generate multiple charts, graphs, and mapping types through a simple, intuitive dashboard interface, making it easy to get helpful information. However, it is difficult to handle complex data by using traditional data visualization software. Perkhofer, Hofer, Walchshofer, Plank, and Jetter (2019) revealed that some users still rely on traditional and simple visualization techniques to deal with complicated issues. The deep insights are hidden to affect the decision-making.

Modern data visualization tools should assist users and consider diverse preferences and requirements by different users and tasks (Bikakis, 2018). The users only need to follow a few basic guidelines to obtain the appropriate data visualization software. User-related features should be considered in data visualization solutions, including interactive interfaces, data connection and flexibility. The study of Enrico and Antonio (2017) also listed several evaluation criteria of data visualization solutions, such as the user scope, license, and latest release version. It is claimed that the most important feature of data visualization tools is an interactive dashboard (Ali, Gupta, Nayak, and Lenka, 2016). However, current visualization techniques fall short of offering a good user experience (Lowe and Matthee, 2020). Few studies examine the

factors behind data visualization's choice from an individual view, and limited research addresses the relationship between data visualization software and the end-users (Fourati-Jamoussi and Niamba, 2016).

1.2 Research Aims

This research aims to select five evaluation criteria: user interface, data source connection, help documentation, price model, and functionality updates, to analyze the choice of current data visualization platforms from IT professionals' perspectives. The researcher chooses IT professionals with an understanding of the data domain to complete the survey to get insightful views about data visualization tools.

1.3 Research Contribution

This research fills the gap of the link between IT user experience and data visualization tools. The results provide users with factors to consider when choosing a data visualization tool. Also, the results suggest the data visualization software design to satisfy the user's intents, leading to greater adoption.

1.4 Report Structure

To achieve this research's purpose, the report is organized as follows. Chapter 2 reviews the five evaluation criteria of data visualization software and the relevant data visualization tools literature. Chapter 3 presents the methodology covering the main research questions and hypothesis, data collection method and data analysis methods. The discussion (Chapter 5) is followed by the results section (Chapter 4), examining the IT professionals' views regarding data visualization tools. Finally, Chapter 6 will present the conclusion and future research.

2. Literature Review

Using different evaluation metrics could help users select the best data visualization tools for the right tasks. This Chapter reviews five evaluation criteria of data visualization software described in the literature's comprehensive data analytics and business intelligence tools. It covers an evaluation guide and some related BI studies, empirical evaluation of data visualization tools and studies of additional features of BI tools. The framework of the literature review has been shown in Figure 1.

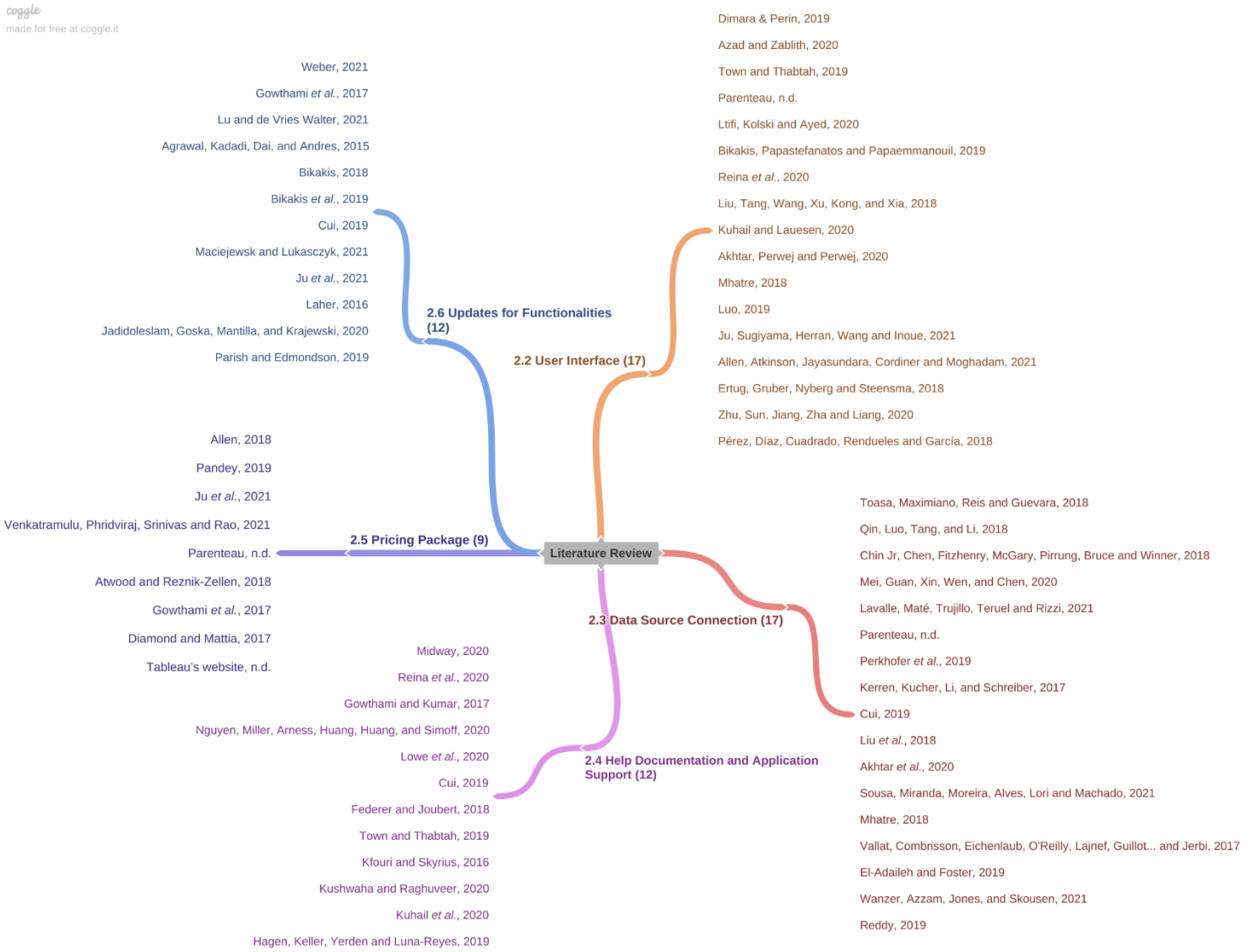

Figure 1 Literature Review Mind Map

2.1 PRISMA Literature Review

The researcher conducts a structured search by following PRISMA guidelines, leading to a qualified literature review. For the literacy search, the researcher uses digital libraries and datasets in Table 1.

Database	Website
ACM Digital Library	https://dl.acm.org/
EBSCOhost	https://web-b-ebscohost-com.wintec.idm.oclc.org/ehost/search/selectdb?vid=0&sid=109e57ea-88b5-47db-9034-f02c617d3bce%40pdc-v-sessmgr02
Google Scholar	https://scholar.google.co.nz/schhp?hl=zh-CN&as_sdt=0,5
IEEE Xplore	https://ieeexplore.ieee.org/Xplore/home.jsp
ScienceDirect	https://www-sciencedirect-com.wintec.idm.oclc.org/

Table 1 The Databases Used in the Literature Review

Inclusion Criteria	Exclusion Criteria
1. Full-text **2.** In English **3.** Peer reviewed articles, conference paper, whitepaper **4.** Published with the selected period (2015 - 2021) **5.** Related to five factors: user interface, data source connection, help documentation and application support, price packaging, and functionality updates **6.** Related to data visualization tools **7.** Key words: data visualization tools + data visualization software + data analytics + evaluation criteria + user interface + interaction + dashboard + data source + help documentation + training + price model + functionality updates	1. Limited access 2. Non-English version 3. Not academic peer reviewed articles 4. Published out of the selected period 5. Not relevant to the topic

Table 2 Inclusion Criteria and Exclusion Criteria of this Literature Review

For academic and professional literature, only peer-reviewed papers published and conference papers in English from 2015 to 2021 are included. The researcher chooses

a 6-year time window to ensure the recency of the reviewed articles. The search strategy was based on the following search terms: “data visualization tools”, “data visualization software”, “data analytics”, “evaluation criteria”, “user interface”, “interaction”, “dashboard”, “data source”, “help documentation”, “training”, “price model”, and “functionality updates”. Table 2 defines the inclusion and exclusion criteria in details.

Here is PRISMA flow chart (Figure 2).

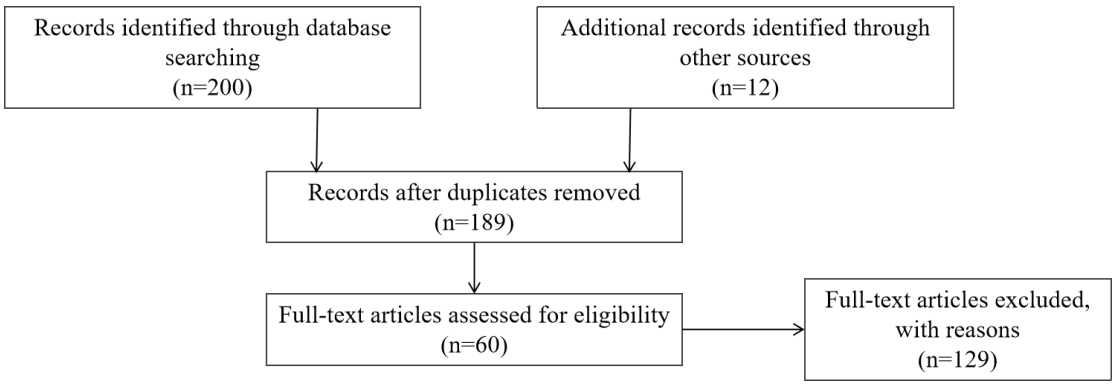

Figure 2 PRISMA Flow Chart

The researcher reviews 212 full papers. The preliminary results consist of 189 scholarly articles, professional reports and conference papers. A review of abstracts results in the eliminations of 129 documents unrelate to data visualization evaluation, leaving 60 data visualization-related papers dated between 2015 and 2021. Seventeen publications were related to the user interface of data visualization platforms, seventeen articles (journal and book sections) propose data source connection and twelve publications discuss help documentation and training of data visualization tools. Only nine papers related to the pricing package of data visualization software and twelve journals refer to functionality updates.

The articles reviewed in this Chapter have been listed in Table 3.

Table 3 List of the Articles in PRISMA Literature Review

No.	Author & Year	Article Name	Research Area	Key Findings	Research Method
1	Raghav, R. S., Pothula,	A survey of data visualization tools	Data visualization tools	The researcher described different	Quantitative

	S., Vengattaraman, T., & Ponnurangam, D. (2016)	for analyzing large volume of data in big data platform		visualization tools and their capabilities. Tableau is helpful to non-programmers to get a deep insight into data.	
2	Enrico, G. C., & Antonio, M. R. (2017)	Big Data Visualization Tools: A Survey - The New Paradigms, Methodologies and Tools for Large Data Sets Visualization	Big data visualization	The researcher showed many visualization solutions are open-source, which means they are suitable for developers. It also highlighted the flexibility of data visualization software.	Quantitative
3	Perkhofer, L.M., Hofer, P., Walchshofer, C., Plank, T. and Jetter, H. C. (2019)	Interactive visualization of big data in the field of accounting: A survey of current practice and potential barriers for adoption	Financial data visualization	The researcher identified the data sources and structures that influence visualization practice and the preference of accounting professionals. In addition, a lack of knowledge and familiarity concerning new visualization tools affect the practice of data analytics.	Quantitative
4	Bikakis, N. (2018)	Big data visualization tools	Visual analytics	Modern data visualization software should provide mechanisms that assist the user and provide customized	Quantitative

				services.	
5	Ali, S. M., Gupta, N., Nayak, G. K., & Lenka, R. K. (2016)	Big data visualization: Tools and challenges	Interactive visualization	The researcher noted that the interactivity of data visualization is of utmost importance. It is also emphasized that clarify the requirements and needs before choosing a visualization tool.	Quantitative
6	Fourati-Jamoussi, F., & Niamba, C. N. (2016)	An evaluation of business intelligence tools: A cluster analysis of user's perceptions	Business intelligence tools	The researcher presented the financial impact of BI tools was not ignored.	Quantitative
7	Gowthami, K., & Kumar, M. P. (2017)	Study on Business Intelligence Tools for Enterprise Dashboard Development	Dashboard of business intelligence tools	The researcher recommended choosing fully open-source data visualization tools where the training, deployment and support can be provided.	Quantitative
8	Balzer, C., Oktavian, R., Zandi, M., Fairen-Jimenez, D., & Moghadam, P. Z. (2020)	Wiz: A Web-Based Tool for Interactive Visualization of Big Data	A web-based data vitalization tool	The researcher highlighted three features: 1. Freely accessible; 2. Built easily with data analytics; 3. Low barrier to entry	Qualitative
9	Dimara, E., & Perin, C. (2019)	What is interaction for data visualization?	Interaction in visualization	The result showed the interaction in visualization relates to user intentionality and profiling.	Quantitative
10	Lee, B., Choe, E. K.,	Reaching Broader Audiences with	Personal data visualization,	The researcher noted that the data	Mixed method

	Isenberg, P., Marriott, K., & Stasko, J. (2020)	Data Visualization	multimodal interaction for data visualization	visualization research still some shorts on serving a group of people, and there are some challenges and chances for visualization researchers.	
11	Parenteau, J. (n.d.).	Evaluation guide: how to choose the right modern BI and analytics platform	Evaluation criteria for selecting the right data visualization platform	It is a guide, which focused on the platform evaluation criteria of the modern BI system. The intended audience is IT professionals, the information consumer, and the requirements include ease of use, user enablement, deployment flexibility, pricing and packaging.	N/A
12	Lowe, J., & Matthee, M. (2020, April)	Requirements of Data Visualization Tools to Analyze Big Data: A Structured Literature Review	User assistance	The researcher identified the requirements of modern data visualization tools and categorized them into six groups: dimensionality reduction, data reduction, scalability and readability, interactivity, fast retrieval of results and user assistance.	Quantitative
13	Ridley, A. L., & Birchall, C.	Evaluating data visualization: Broadening the	Data visualization evaluation	The researcher highlighted the importance of	Mixed method

	(2020)	measurements of success		measurements to data visualization development. They also combined different evaluative practices with other users, such as designer, programmer.	
14	Reina, G., Childs, H., Matković, K., Bühler, K., Waldner, M., Pugmire, D., ... & Krone, M. (2020).	The moving target of visualization software for an increasingly complex world	User guidance, training	The researchers discussed the challenges, solutions that affect data visualization development. They also provided a suggestion that good and up-to-date help documentation could improve the usability for users and developers.	Mixed method
15	Kuhail, M.A. and Lauesen, A.S. (2020).	Uvis: a formula-based end-user tool for data visualization	Customize data visualization	The researcher compared Uvis with other popular visualization tools, and the results show that end-user developers without programming skills can learn the basics of Uvis fast, and they can customize visualizations.	Mixed method
16	Liu, J., Tang, T., Wang, W., Xu, B., Kong, X., & Xia, F. (2018)	A Survey of Scholarly Data Visualization	Analysis of features of data visualization tools	This study introduced generic visualization tools, including tools without the programming language and tools based on a programming language. The	Quantitative

				researcher analyzed the features of data visualization tools.	
17	Akhtar, N., Perwej, A., & Perwej, Y. (2020)	Data analytics and visualization using Tableau utilitarian for COVID-19	A review about Tableau	The researcher provided a comprehensive review of Tableau. Tableau can provide more understandable and presentable outputs, and its feature includes data blending, real-time reporting and collaboration. Beyond that, Tableau can collect information from any platform.	Quantitative
18	Atwood, T. P., & Reznik-Zellen, R. (2018)	Using the Visualization Software Evaluation Rubric to explore six freely available visualization applications	A rubric for evaluating data visualization tools	In this study, the authors guided several freely available data visualization tools and offered a rubric for evaluation. The results showed RawGraphs and Tableau Public got high marks.	Quantitative
19	Pandey, P. (2019)	11 free tools to get started with data visualization easily and instantly	Introduction of free available data visualization tools	This online article introduced some popular tools like Tableau Public, Power BI and Google Charts, which are commonly used in the data domain.	N/A
20	Federer, L. M., & Joubert, D. J. (2018)	Providing Library Support for Interactive Scientific and	Help resources of Tableau	This article provided a basic introduction to Tableau's use and	Quantitative

		Biomedical Visualizations with Tableau		offers examples of different applications for Tableau. The most important is to give some learning resources for Tableau and insights on creating a successful learning support service.	
21	Merino, L., Ghafari, M., Anslow, C., & Nierstrasz, O. (2018).	A systematic literature review of software visualization evaluation	The problems and challenges of data visualization evaluation	This research provided some suggestions on evaluating data visualization tools, such as increasing accuracy, usability, and user engagement.	Mixed method
22	Town, P., & Thabtah, F. (2019)	Data analytics tools: A user perspective	Comparison between Tableau and Microsoft Power BI	This paper focused on Tableau and Microsoft Power BI to identify which one is better for data analysis from user's perspectives. The results showed that Tableau ranked higher than Power BI with its available training and help. Power BI ranked more highly on its interface. They organized the same on the cost.	Quantitative
23	Diamond, M., & Mattia, A. (2017).	Data visualization: an exploratory study into the software tools used by businesses	Comparison of various data visualization software's functionality	The researcher explored various data visualization software, such as Microsoft Power BI, Qlik View,	Quantitative

				Tableau. The researcher also analyzed the functionalities of software to provide insight for business schools to determine which tools are worth investing in and learning.	
24	Mhatre, S.A. (2018)	Data analytics & visualization using Qlik	Review of Qlikview	The researcher discussed the power of Qlikview from user interface and scripting ability.	Quantitative
25	Kfouri, G., & Skyrius, R. (2016).	Factors influencing the implementation of business intelligence among small and medium enterprises in Lebanon	Factors influence BI tool used in an organization	The researcher identified the factors from three broad perspectives: organizational, processes and technologies. The researcher highlighted the BI skills is the most critical issues in BI adoption.	Mixed method
26	El-Adaileh, N. A., & Foster, S. (2019).	Successful business intelligence implementation: a systematic literature review	Factors related to successful BI adoption: sources of data, user participation	The researcher identified some factors that influence BI tools adoption: management support, data sources, IT infrastructure, user participation.	Quantitative
27	Tableau website (n.d.)	How to evaluate BI tools	Evaluation of data visualization tools.	This online article offered five things to consider when evaluating data visualization tools. For example,	N/A

				deployment options, deep analytics without a programming language, self-services, cost.	
28	Agrawal, R., Kadadi, A., Dai, X., & Andres, F. (2015, October)	Challenges and opportunities with big data visualization	Challenges of current data visualization tools.	The researcher reviewed some current data visualization tools and identified some challenges: interactive scalability, data reduction, etc.	Quantitative
29	Qin, X., Luo, Y., Tang, N., & Li, G. (2018)	Deepeye: An automatic big data visualization framework	Data visualization automation	This research aimed to automate data selection, filter and transformation of data visualization systems. The researcher presented DEEPEYE system to address the challenges of automation.	Quantitative
30	Reddy, K. (2019)	Interactive Graph Data Integration System with Spatial-Oriented Visualization and Feedback-Driven Provenance	The usability of databases	The researcher emphasized the importance of providing a user-friendly interface to search and integrate databases to relieve the user's burden of understanding the various database query languages and complexity.	Quantitative
31	Cui, W. (2019)	Visual analytics: A comprehensive overview	Data visualization and visual analytics	The researcher provided a comprehensive survey of visual data analytics and	Quantitative

				proposed data analytics challenges, such as collaboration, scalability and interaction.	
32	Lavalle, A., Maté, A., Trujillo, J., Teruel, M. A., & Rizzi, S. (2021)	A methodology to automatically translate user requirements into visualizations: Experimental validation	An experiment of using data visualization tools by non-expert users	This research aims to evaluate the understandability and effectiveness of data visualization software from the non-expert users' perspectives.	Qualitative
33	Ju, Y., Sugiyama, M., Herran, D. S., Wang, J., & Inoue, A. (2021)	An open-source tool for visualization of climate mitigation scenarios: Mipplot	Features of Mipplot	The researchers presented the Mipplot tool, an open-source R package with simple commands and a user-friendly interface. Moreover, it has the function of displaying different language, and it is free to use to extends a broader range of users. However, there is still some room for improvements.	Quantitative
34	Luo, W. (2019).	User choice of interactive data visualization format: The effects of cognitive style and spatial ability	Choice of data visualization format	The researcher investigated the preference and choice of data visualization format from cognitive style, spatial ability and task difficulty. The results have shown that the choice of data visualization format	Qualitative

				is influenced by the users' cognitive style and task difficulty.	
35	Hagen, L., Keller, T. E., Yerden, X., & Luna-Reyes, L. F. (2019)	Open data visualizations and analytics as tools for policy-making	Data visualization and analytics	The researcher suggested providing training and guidelines with the visual analytics tools can increase usability.	Qualitative
36	Chin Jr, G., Chen, Y., Fitzhenry, E., McGary, B., Pirrung, M., Bruce, J., & Winner, S. (2018)	A visual analytics platform and advanced visualization tools for interpreting and analyzing wind energy time-series data	Data analytic visual platform	The researcher developed a visual analytics platform to connect the existing wind data sources and integrate them into advanced visualization tools. They highlighted the importance of data source connection in data visualizations.	Quantitative
37	Bikakis, N., Papastefanatos, G., & Papaemmanouil, O. (2019)	Big data exploration, visualization and analytics	Data visualization and analytics	This research provides some suggestions on improved data visualization tools, such as scalable data management techniques and customizes capability for different users.	N/A
38	Ltifi, H., Kolski, C., & Ayed, M. B. (2020)	Survey on Visualization and Visual Analytics pipeline-based models: Conceptual aspects, comparative	Evolution of the field of data visualization research	This study described different evolution of visualization research and discussed the challenges and opportunities within	Quantitative

		studies and challenges		this field.	
39	Wanzer, D. L., Azzam, T., Jones, N. D., & Skousen, D. (2021)	The role of titles in enhancing data visualization	Efficiency and aesthetics of data visualization affect by titles	The researcher presented a significant challenge in supporting the harmony between efficiency and aesthetics of user exploration, inspection, and data communication.	Qualitative
40	Kushwaha, M., Bissa, A., & Raghuveer, V. R. (2020).	Visualization of Agriculture Data of Rajasthan: An Application of R	High functionality and flexibility of R	The researchers demonstrated R is easy to extend, especially for pre-processing and fusion of data frames. It can visualize all data frames in different orientations.	Quantitative
41	Jadidoleslam, N., Goska, R., Mantilla, R., & Krajewski, W. F. (2020).	Hydrovise: A non-proprietary open-source software for hydrologic model and data visualization and evaluation	An open-source software for data visualization and evaluation	The researchers develop a tool that can benefit from the user community's feedback, feature requests, improvements and developments from the developer community.	Quantitative
42	Nguyen, Q. V., Miller, N., Arness, D., Huang, W., Huang, M. L., & Simoff, S. (2020).	Evaluation on interactive visualization data with scatterplots	Evaluation of three types of techniques of scatterplots	The researchers illustrated that newer interactive technologies require further training to be better used by new users and thus produce accurate results.	Qualitative
43	Venkatramulu, S.,	Implementation of Grafana as open-	Introduction of Grafana	The researchers revealed that	N/A

	Phridviraj, M. S. B., Srinivas, C., & Rao, V. C. S. (2021).	source visualization and query processing platform for data scientists and researchers		Grafana has a free version, and it provides the excellent powers and features to import the data sources from a wide range of database engines.	
44	Lu, Y and de Vries Walter T. (2021).	A Bibliometric and Visual Analysis of Rural Development Research	Visual analysis of rural development research	The researchers described four computer-based software tools to aid in data collection, data analysis, and visualization. It was emphasized that there are free versions of these tools and that they are continuously updated.	Quantitative
45	Sousa, R., Miranda, R., Moreira, A., Alves, C., Lori, N., & Machado, J. (2021).	Software Tools for Conducting Real-Time Information Processing and Visualization in Industry: An Up-to-Date Review	Review of data visualization tools	The researchers described how visualization tools work and the advantages and disadvantages of using them. They highlighted the Power BI and explained it could deal with various data sources and customized interface.	N/A
46	Kerren, A., Kucher, K., Li, Y. F., & Schreiber, F. (2017).	BioVis Explorer: A visual guide for biological data visualization techniques	Data visualization in biosciences	The researchers reviewed the visualization research in biosciences and created an interactive	Quantitative

				visualization tool that provides interactive and intuitive filtering data.	
47	Toasa, R., Maximiano, M., Reis, C., & Guevara, D. (2018, June)	Data visualization techniques for real-time information-A custom and dynamic dashboard for analyzing surveys' results	Review of dashboard platforms and techniques of data visualization	The researchers reviewed some data visualization platforms and highlighted these techniques have an interactive dashboard that connects large datasets for non-technique users.	Quantitative
48	Ertug, G., Gruber, M., Nyberg, A., & Steensma, H. K. (2018)	From the editors - A brief primer on data visualization opportunities in management research	Data visualization techniques for management researchers	The researchers discussed different visualization tools and software packages. They revealed that the management researchers prefer aesthetically interactive interface.	Quantitative
49	Weber, T. (2021)	Update 2.0 to "Takin: An open-source software for experiment planning, visualization, and data analysis", (PII: S2352711016300152)	New release of Takin	The researcher emphasized the significance of functionality updates based on user experience, which improves stability and performance.	N/A
50	Laher, R. R. (2016)	Thoth: Software for data visualization & statistics	New data visualization and analysis tool: Thoth	The researcher described that Thoth currently has some shortcomings, such as no 3D data plotting capability and no function	Quantitative

				representation. Future upgrades to Thoth depend on obtaining support for its continued development.	
51	Vallat, R., Combrisson, E., Eichenlaub, J. B., O'Reilly, C., Lajnef, T., Guillot, A., ... & Jerbi, K. (2017).	Sleep: a python open-source software for visualizing and scoring sleep data	An open-source visualization software: Sleep	The researchers identified that Sleep could efficiently process and display large datasets with fast and high-level visualization.	N/A
52	Mei, H., Guan, H., Xin, C., Wen, X., & Chen, W. (2020)	Datav: Data visualization on large high-resolution displays	Design of data visualization tool	The authors showed that designers of visualization tools must consider many factors, including multiple sources of heterogeneous data, connections between data and context, and argued that it is excellent but untapped potential for data fusion, collaborative design, and communicative visualization.	Quantitative
53	Midway, S. R. (2020)	Principles of Effective Data Visualization	Effective use data visualization tools	The author illustrated most data visualization software is readily available or accessible, and many have extensive online help resources to	N/A

				help users get to grips with the software.	
54	Allen, W. L. (2018)	Visual brokerage: Communicating data and research through visualization	Approach to data visualization	The researcher presented those free and low-cost visualization tools are widespread, increasingly expose users to data, and allow users to explore data according to their interests.	Qualitative
55	Zhu, S., Sun, G., Jiang, Q., Zha, M., & Liang, R. (2020)	A survey on automatic infographics and visualization recommendations	Visualization recommendation	The researchers mentioned that data visualization tools are increasingly becoming automated.	Quantitative
56	Allen, L., Atkinson, J., Jayasundara, D., Cordiner, J., & Moghadam, P. Z. (2021)	Data visualization for Industry 4.0: A stepping-stone toward a digital future, bridging the gap between academia and industry	Advanced data visualization dashboard	The authors mentioned that create easy-to-use visualization software to realize the full value of the data.	N/A
57	Parish, C. M., & Edmondson, P. D. (2019)	Data visualization heuristics for the physical sciences	Data visualization in materials science	The researchers provided data visualization heuristics adapted to the specific needs of the materials science community.	Quantitative
58	Pérez, D., Díaz, I., Cuadrado, A. A., Rendueles, J. L., & García, D. (2018)	Interactive data visualization of chatter conditions in a cold rolling mill	Interactive visualization	The researchers highlighted that it quickly explores information through interactive data visualization, and interactive visualization could	Quantitative

				integrate user domain knowledge in the analysis.	
59	Azad, B., & Zablith, F. (2020)	How digital visualizations shape strategy work on the frontlines	Strategy visualization research	The researchers have shown that the critical visualization feature is a highly interactive interface, and a high level of digital visualization design can support an open strategy.	Qualitative
60	Maciejewski, R., Ma, Y., & Lukasczyk, J. (2021)	The Visual Analytics and Data Exploration Research Lab at Arizona State University	Advance in visualization	The authors described some advances in visualization, while also presenting challenges in multivariate cartographic representation, classification, and uncertainty.	Quantitative

2.2 User Interface

The user interface is defined as operationalizing flexibility and interactivity within visualization systems, which is fundamental to data visualization tools (Dimara & Perin, 2019). Azad and Zablith (2020) also mention that the critical feature of data visualization is the highly interactive interface. Town and Thabtah (2019) explain the interface criteria relate to the navigation through the software, the ease of finding specific commands, and how easy it to handle multiple tables and graphs. In the whitepaper of Parenteau (n.d.), interaction is the initial phase for evaluating data visualization tools.

Visualization technique is a thriving research field, and one branch of which is that it supports users for data analysis using interactive visual interfaces (Ltifi, Kolski and

Ayed, 2020). According to Dimara *et al.* (2019), it is a growing call for enriching interactivity in visualization software. Many visualization techniques provide users with an intuitive means of interactive data exploration and patterns (Bikakis, Papastefanatos and Papaemmanouil, 2019). A good user interface for data visualization tools is a continuing research topic, and it evolves as advanced technology becomes available (Reina *et al.*, 2020). Many types of research promote novel and bolder interaction design practices in the visualization system to spur more flexible visualization tools.

For achieving a wider audience, the user interface of data visualization platforms must be easy to use for both non-expert and expert users. Liu, Tang, Wang, Xu, Kong, and Xia (2018) present that Tableau provides flexible and interactive graphs, which allow users to analyze their data characteristics from multiple perspectives. Kuhail and Lauesen (2020) illustrate that Tableau integrate data well and help users explore the data without requiring programming skills. Akhtar, Perwej and Perwej (2020) demonstrate that Tableau is a modern data analysis and visualization software that provides flexibility and ease of use with a smooth user experience. In addition to Tableau, Qlikview is a powerful tool of descriptive statistical graphics, and it allows users to create and develop analytic applications without professional skills (Mhatre, 2018). Luo (2019) also highlights that Qlikview has a function that is relatively easy for users to select or switch between visual formats. Ju, Sugiyama, Herran, Wang and Inoue (2021) present the Mipplot tool can generate charts in multiple languages with simple commands and a user-friendly language platform. Its interactive interface offers excellent flexibility and is suitable for experts and non-experts. In addition, the function to display different languages makes Mipplot suitable for a broader range of users (Ju *et al.*, 2021).

Data visualization has various solutions, and many users choose one specific platform because it is easy to use (Reina *et al.*, 2020). Allen, Atkinson, Jayasundara, Cordiner and Moghadam (2021) mention that easy-to-use visualization software lowers the threshold for understanding and analyzing large data sets, thus enabling more people

to use the software. The management personnel prefer a visualization tool with a user-friendly interface for importing data and generating different charts (Ertug, Gruber, Nyberg and Steensma, 2018). According to Zhu, Sun, Jiang, Zha and Liang (2020), designers need to simplify the dashboard of visualization tools to enable users to generate visual charts efficiently. The study shows that information can be easily explored through interactive data visualization (Pérez, Díaz, Cuadrado, Rendueles and García, 2018).

Many previous works of literature emphasize the importance of a user-friendly interface in data visualization software. Therefore, the researcher considers that interactivity and data visualization tools' flexibility may affect visualization tools selection.

H 1. User interface influences IT professionals to choose data visualization tools.

2.3 Data Source Connection

Another essential feature of the data visualization tool is data access and integration. Data visualization techniques need to have a great potential for mining large and multiple databases (Toasa, Maximiano, Reis and Guevara,2018). Qin, Luo, Tang, and Li (2018) present the essential task of data visualization: selecting, filtering, and transforming the data. Chin Jr, Chen, Fitzhenry, McGary, Pirrung, Bruce and Winner (2018) also emphasize that developing the visual platform is to connect data sources, integrate sources and then provide advanced visualizations. When designing visualization tools, designers must consider many factors, including multiple sources of heterogeneous data and the connection between data and context (Mei, Guan, Xin, Wen, and Chen, 2020). Therefore, data sources connection is critical for data visualization software.

Some article demonstrates that data visualization tools must consider the changing needs of users, consider the unstructured and structured data sources, provide easy access and a better understanding of the datasets (Lavalle, Maté, Trujillo, Teruel and

Rizzi, 2021). In the whitepaper of Parenteau (n.d.), one evaluation criterion of a data visualization software is that the platform needs broad connectivity options to involve structured, semi-structured, and unstructured data sources. According to Perkhofer *et al.* (2019), accounting professionals use semi-structured and unstructured data sources to adopt data visualization techniques, which influence the choice and practice of visualization tools. One challenge of using biological data visualization is data types and properties (Kerren, Kucher, Li, and Schreiber, 2017). In the data analytics process, data uncertainty can lead to misinterpreted data analytics results and affect the credibility of data visualization applications (Cui, 2019). Therefore, data integration is one of the most critical evaluation criteria.

Tableau supports various data file formats, and it also has several database interfaces for importing data from online servers (Liu *et al.*, 2018). The study of Akhtar *et al.* (2020) also reveals that Tableau is a powerful tool that accesses various datasets and is why people use Tableau to visualize the data. Besides, Power BI can handle connections to a large number of data sources in a variety of formats, from Excel, CSV/text, JSON, XML files, or both relational and non-relational databases, that can be hosted locally or in the cloud (Sousa, Miranda, Moreira, Alves, Lori and Machado, 2021). Additionally, Power BI can simultaneously retrieve data from multiple data sources (Sousa *et al*., 2021). Mhatre (2018) also presents that Qlikview provides a scripting editor, allowing developers to connect to various data sources using Structured Query Language. Sisense is a data visualization tool that helps non-technical users to combine multiple datasets and generate data visualizations (Toasa *et al.*, 2018). Beyond that, Sleep is a data analysis visualization tool capable of efficiently handling and displaying large data sets. It also supports loading and reading raw data from standard file formats, in addition to a range of commercial data formats (Vallat, Combrisson, Eichenlaub, O'Reilly, Lajnef, Guillot... and Jerbi, 2017).

Data source connection heavily affect the usage of data visualization platforms (El-Adaileh and Foster, 2019). However, it is a challenge for data visualization tools to support users in exploring, examining, and communicating with data (Wanzer,

Azzam, Jones, and Skousen, 2021). The research community recognized that providing a more user-friendly interface to search and integrate databases is an important issue, and it has received wide attention from academic research departments at universities and industrial research groups (Reddy, 2019).

Many studies have focused on whether the data connectivity features in data visualization tools can meet the needs of both professionals and non-professional users. Therefore, this factor can be prioritized in this study and it may affect IT users' choice of data visualization software.

H 2. Data source connection influences IT professionals to choose data visualization tools.

2.4 Help Documentation and Application Support

The best data visualization tools not only need to be simple to use, but they are also supported by excellent documentation and handy tutorials, which allow people to master all the tools at hand efficiently. Most data visualization software has available and extensive online help resources (Midway, 2020).

The help documentation needs to include user manuals, feature lists, tutorials, and examples (Reina *et al.*, 2020). Gowthami and Kumar (2017) also emphasize a learning support feature includes self-paced video tutorials and presentation through slide share and an additional feature that provides a forum to support users to report the bugs of tools. Besides, Reina *et al.* (2020) study the concept of "user guidance", which means data visualization tools could provide hints and tooltips in the user interface, as well as "Wizard" dialogues.

Today, most of the effort devoted to the data visualization software functionality, while the help documentation is a lower priority. Nguyen, Miller, Arness, Huang, Huang, and Simoff (2020) note that some of the complex charts in the data visualization tool require further training before the technique can be used more effectively. Lowe *et al.* (2020) also present that the currently available data

visualization still needs some improvements to provide users with appropriate assistance. In addition, Cui (2019) suggests that collaboration and information sharing are potential research directions of data visualization platforms.

Federer and Joubert's (2018) study show that getting close to the community is critical to establish a successful data visualization platform. For example, Tableau provides a wide availability of free training documentations to be very approachable and easy to learn. Also, Town and Thabtah (2019) present that Microsoft Power BI is self-service software for users. It provides valuable links to forums, blogs, and introductory videos, and any skill level of user can make powerful reports and dashboards to use with an intuitive interface. In Kfouri and Skyrius (2016) study, the user's skill is the critical issue that affects choosing data analytics tools. It has also shown a lack of guidance for data analytics tools implementation (Kfouri *et al.*, 2016).

Reina *et al.* (2020) present some common barriers for data visualization software users, including a lack of comprehensive documentation. Another obstacle is that not all IT professionals know the same programming languages. Therefore, IT users may need to learn a new programming language or search for another visualization tool, which will lead to delays (Reina *et al.*, 2020). For IT users, essential aspects of choosing the right data visualization tool are the programming language, platform and framework (Kushwaha and Raghuveer, 2020). Reina *et al.* (2020) conclude that IT professionals prefer software with features such as stability, platform support and appropriate coding styles. They suggested the help documentation should include adding additional functionality, the coding style and practice (Reina *et al.*, 2020).

Additionally, Kuhail *et al.* (2020) assess the learnability of data visualization tools, and the end-users with IT skills without programming skills can learn rapidly. Most data visualization tools have training documentation, allowing users to search and find answers to software-specific questions. Some research suggested providing training and interpretation guidelines on data visualization tools can increase usability and reduce barriers to adoption (Hagen, Keller, Yerden and Luna-Reyes, 2019).

Therefore, the generation and updates of documentation and learning support for users helps lower the barriers and be involved in evaluation consideration in this research. The researcher assumes that help documentation is likely to affect IT users to choose data visualization software.

H 3. Help documentation influences IT professionals to choose data visualization tools.

2.5 Pricing Package

With the popularity of free and low-cost visualization tools, more and more users are exposed to data (Allen, 2018). Most users choose freely available data visualization tools when they are just getting started in data visualizations. Some popular free software such as Tableau Public, Power BI, Excel and Google Charts are used commonly by end-users (Pandey, 2019). Ju *et al.* (2021) mention that one reason of Mipplot tool extends its applicability to a broader range of users is that the users can download it for free and get full access to it. Also, the cloud version of Grafana is free, and therefore, it is used directly by many data engineers and researchers (Venkatramulu, Phridviraj, Srinivas and Rao, 2021).

Parenteau (n.d.) states that pricing and packaging are also cored attributes to evaluate data visualization tools. Atwood and Reznik-Zellen (2018) create a rubric for use in assessing data visualization tools, and one element of the rubric is the cost for the "full" version. In the study of Gowthami *et al.* (2017), they compare various data visualization platforms from a price model that influence the software deployment, and the Microsoft Power BI and Qlik Sence have accessible trails. However, in the study of Diamond and Mattia (2017), the pricing factor has not been considered when they assessed various data visualization tools, such as Power BI and Excel, from individuals' perspectives. Tableau's website (n.d.) presents the total cost that needs to be considered when evaluating data visualization platforms.

Based on previous literature, it is necessary to conduct a comprehensive price

comparison instead of the price tag. Therefore, in this research, the pricing factor will be considered as an evaluative criterion to achieve a complete result. The researcher hypotheses the pricing package is likely to affect expert users to use data visualization software.

H 4. Pricing package influences IT professionals to choose data visualization tools.

2.6 Updates for Functionalities

Based on practical experience and user interaction, updates to the current version will significantly improve user-friendliness and stability and performance (Weber, 2021). In addition to free personal accounts, some data visualization tools also provide more powerful professional accounts, and the functionalities are updated frequently. According to Gowthami *et al.* (2017), several data visualization tools are available in different versions and functionalities for individuals, teams and businesses, such as Qlik Sence Desktop, Olik Sence Enterprise, and Qlik Sence Cloud. All of these versions provide broad support through functionality training. Lu and de Vries Walter (2021) also introduce four visual analytics tools and highlight these tools continuously updated with new versions, with a new version being posted online every few months.

On the other hand, Agrawal, Kadadi, Dai, and Andres (2015) present data visualization platforms that have reached their limitations since the data grows constantly more significant. These limitations bring opportunities for functionality updates of data visualization platform, such as reducing latency and interactive scalability (Agrawal *et al.*, 2015). According to Bikakis (2018), modern data visualization systems have a common issue: data overloading, so data abstraction functions need to be addressed. Bikakis *et al.* (2019) also suggest that modern visualization techniques should provide scalable data management techniques to process large datasets efficiently. In addition, Cui (2019) presents a growing mismatch between data visualization platforms' data complexity and interactivity, making the scalability of data visualization tools a challenge. Some algorithms have been investigated to improve scalability, but they are somewhat limited because they

are too slow to interactively, hindering the data analysis process (Cui, 2019). In Maciejewski and Lukasczyk's (2021) study, multivariate mapping functions need to be noticed in the development of data visualization tools. Ju *et al.* (2021) add that there is some room to improve the current functionality of Mipplot to meet the needs of experts and non-experts better. For example, it could extend the existing data consistency checking function for expert users, and for non-experts, it should provide more detailed guidance on filters in the future. According to Laher (2016), some data visualization tools with powerful features are still flawed, such as the lack of 3D data plotting capabilities and the representation of functions. Then the success of the data visualization tool depends on whether the software can be upgraded to have capabilities that it did not have before.

Jadidoleslam, Goska, Mantilla, and Krajewski (2020) believe the most critical factor in the success of data visualization software is to further improve the user experience and functions through user contributions and feedback. Functionalities updates can lead to smarter decisions, faster performance and simpler than ever before. However, there is less study to consider this factor in data visualization evaluation. Many publications discuss rules and heuristics for improving data visualization, but few have general recommendations (Parish and Edmondson, 2019).

To fulfil this gap, the final consideration of choosing flexible data visualization tools to meet user's needs updates for functionalities. The researcher thinks that functionality updates may affect IT users to select data visualization software.

H 5. Functionality updates influence IT professionals to choose data visualization tools.

2.7 Conclusion

Recent research focuses on the evaluative criteria of data visualization platforms. Still, there is a shortage of research on data visualization tools for individuals, and user experiences are always ignored. Town and Thabtah (2019) compare Tableau and

Microsoft Power BI from undergraduate information technology students' perspectives. It uses interface, price, available training and helps documentation as the evaluation criteria. However, Town and Thabtah's study lacked other data visualization tools and other critical evaluation criteria. The end users are only focusing on tertiary IT students. Therefore, this research intends to utilize five critical evaluative criteria and provide multiple data visualization tools for IT professionals, including tertiary IT learners and experienced IT workers. Chapter 3 will discuss the methodology, research questions and the corresponding hypothesis, research design and instrument, sampling method and data collection method, and data analysis approaches.

3. Methodology

This chapter presents the research methodology. This research aims to identify the factors that influence IT professionals using data visualization tools in China and New Zealand. The researcher adopts a quantitative approach after considering the scope, depth and limitations of this research. This research conducts a significant online survey to analyze the elements, including user interface, data source connection, help documentation, pricing package and updates for functionalities. In more details, this chapter includes research questions, hypotheses, research design, research instrument, sample method, data collection method, the type of data analysis, and limitations of methodology.

3.1 Research Questions and Hypotheses

The researcher needs to consider the philosophical worldview before starting research. The research design and methodology are related to this worldview. Creswell (2014) provides four philosophical worldviews: Postpositivism, Constructivism, Transformative and Pragmatism (p. 36), and discusses these four different worldviews impact several aspects of the research process.

Postpositivism	Constructivism
• Determination • Reductionism • Empirical observation and measurement • Theory verification	• Understanding • Multiple participant meanings • Social and historical construction • Theory generation
Advocacy/Participatory	**Pragmatism**
• Political • Empowerment Issue-oriented • Collaborative • Change-oriented	• Consequences of actions • Problem-centered • Pluralistic • Real-world practice oriented

Figure 3 Four Philosophical Worldviews (Creswell, 2014, p.36)

Postpositivism is to determine which causes influence a particular outcome.

According to Creswell (2014), Postpositivism first chooses a theory that they believe will govern the world and then collect data to see these data either support or reject the hypothesis. Therefore, the researcher chose Postpositivism in this research. Creswell (2014) presented Postpositivism worldview is applicable in quantitative research more than qualitative, so that a quantitative research method is adopted in this research.

This research aims to discover potential factors that influence IT professionals' choice of data visualization tools. Some studies address the user experience of data visualization, but little research focuses on IT professionals. This research mainly focuses on analyzing the factors from IT professionals' perspectives. The participants are collected from China and New Zealand.

The main research question that aims to address this research's purpose is "What are the factors that influence IT professionals to choose data visualization tools in China and New Zealand?"

Based on Chapter 2 Literature Review, five dependent variables are considered, and the researcher generates the following five sub-research questions:

RQ 1. Does the user interface influence IT professionals to use data visualization tools?

RQ 2. Does data source connection influence IT professionals to use data visualization tools?

RQ 3. Does help documentation influence IT professionals to use data visualization tools?

RQ 4. Does pricing package influence IT professionals to use data visualization tools?

RQ 5. Does functionality updates influence IT professionals to use data visualization tools?

The corresponding hypotheses are:

H 1. User interface influences IT professionals to choose data visualization tools.

H 2. Data source connection influences IT professionals to choose data visualization tools.

H 3. Help documentation influences IT professionals to choose data visualization tools.

H 4. Pricing package influences IT professionals to choose data visualization tools.

H 5. Functionality updates influence IT professionals to choose data visualization tools.

3.2 Research Design

The cultural lenses, educational and class background can influence the choice of data visualization tools (Ridley and Birchall, 2020). Therefore, the researcher identifies user characteristics as independent variables that include age, occupation and gender. Based on a systematic literature review, the researcher identifies the five critical evaluative criteria: user interface, data source connection, help documentation, price package and functionality updates, and all of these dimensions are treated as dependent variables.

There are five research questions and five corresponding hypotheses. The theoretical framework for this research is shown in Figure 4.

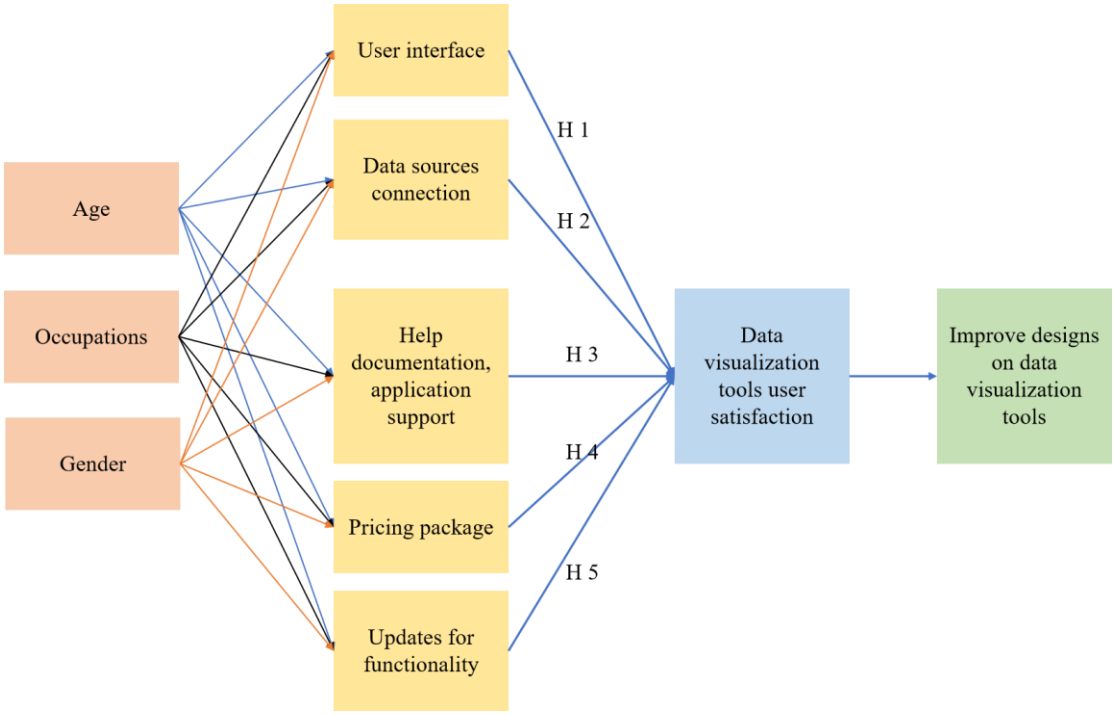

Figure 4 A Theoretical Framework for this Research

Figure 5 presents the relationships among the independent variables, dependent variables, sub-research questions and hypothesis.

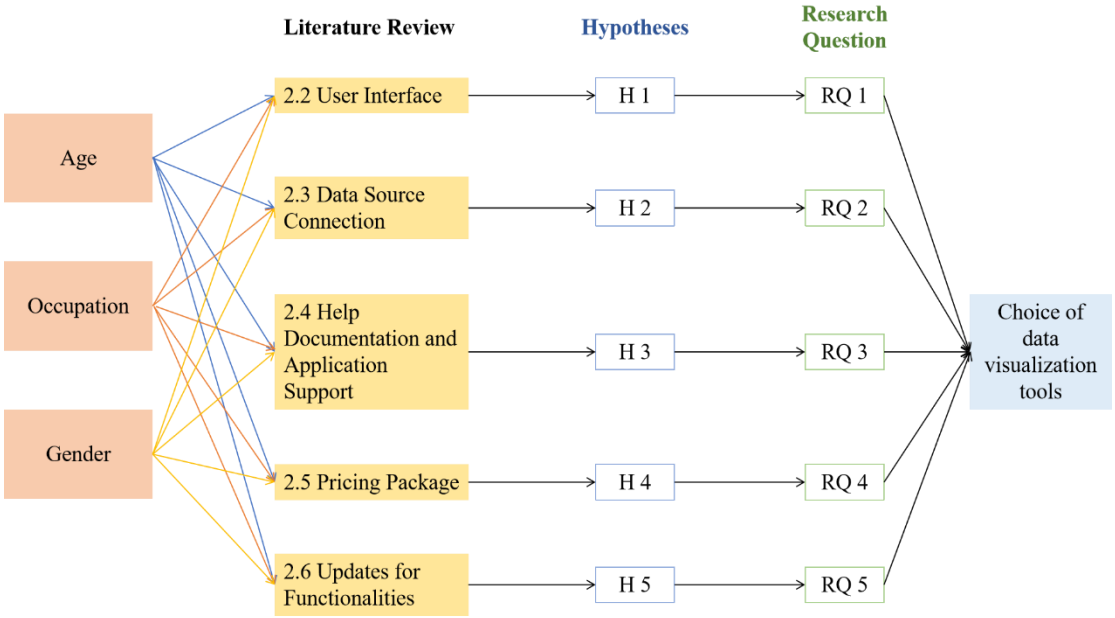

Figure 5 Connection of Independent and Dependent Variables, Hypotheses, and Research Questions with the Theoretical Framework

The researcher uses an online survey questionnaire to collect data, and it has 24 questions. The relationship of survey questions, sub-research questions, hypotheses and literature review are shown in Table 4.

	Literature review	Hypotheses	Sub-RQs	Survey questions
Main Research Question	2.2 User Interface	H 1	RQ 1	S 8, 9, 10, 11, 12
	2.3 Data Source Connection	H 2	RQ 2	S 13, 14
	2.4 Help Documentation and Application Support	H 3	RQ 3	S 15, 16, 17, 18
	2.5 Pricing Package	H 4	RQ 4	S 19, 20, 21, 22
	2.6 Updates for Functionalities	H 5	RQ 5	S 23, 24

Table 4 Links among Survey Questions, Sub-research Questions, Hypotheses and Literature Review

3.3 Research Instrument

The survey is designed to ask several questions to determine the user's views of specific criteria of the data visualization tools they used. Some evaluative questions were developed using a Likert scale to assess the level of the user's views. Appendix B shows a sample of the survey questions.

For this research, the target users are IT professionals, covering tertiary IT learners and experienced IT workers. The requirements of other individuals or groups are excluded from this survey. The researcher needs to know about participants' educational background and working experience to achieve the target participants. Therefore, LinkedIn (international version) can be work as the primary data collection instrument in this research. The researcher assumes that this online survey could be better completed by targeting experienced IT workers in China and New Zealand found on LinkedIn (international version) based on their profiles.

3.4 Sample Method

Selecting and applying the most appropriate visualization tools is complicated, especially dealing with big data. In some cases, basic data knowledge is usually required to create a suitable visualization (Lavalle *et al.*, 2021). Therefore, the researcher selects IT professionals who know the data field to carry out the survey to obtain their in-depth views on data visualization tools.

According to the key industries and job market on the website of New Zealand

Immigration (searched on 2021), nearly 75,000 people are employed in ICT-related roles (New Zealand Immigration, n.d.). However, it is difficult to find out how many IT workers in China precisely. According to Survey System (n.d.), the sample size would be 382.

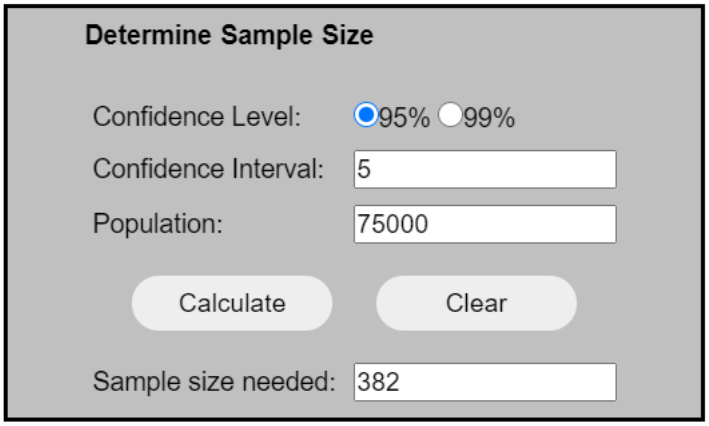

Figure 6 Sample Size Calculator (Survey System, n.d.)

3.5 Data Collection Method

The researcher uses LinkedIn (international) as an online survey tool and gathers data via a statistically significant survey. The survey questionnaire includes 24 questions, which are created based on evaluation criteria in the literature review. The survey got ethics approval from Wintec. Please see the attached survey questionnaire in Appendix B.

After receiving ethics approval, the researcher tests the survey link within a small group and then sents the survey link to IT professionals in New Zealand and China. The survey started on March 24, 2021, ended on April 28, 2021.

A total of 502 participants carried out this online survey. 437 participants are IT professionals, and only 388 participants are IT professionals who use data visualization tools. Therefore, 388 pieces of feedback were considered for data analysis.

3.6 Data Analysis Method

For achieving more accurate and reliable data analysis, some techniques and software of quantitative research are examined in this part. According to Ong *et al.* (2017), two common theories are usually used: statistical comparison analysis and correlation statistical analysis theories. The researcher needs to understand univariate, bivariate and multivariate statistical test based on research hypotheses.

3.6.1 Cronbach's Alpha

Cronbach's alpha is a measure of internal consistency, and it is considered to be a measure of scale reliability. According to Tavakol *et al.* (2011), the resulting α coefficient of reliability ranges from 0 to 1 in providing this overall assessment of a measure's reliability. A reliability coefficient of .70 or higher is considered "acceptable" in most social science research situations. The researcher will use Cronbach's alpha to assess the reliability of the survey.

3.6.2 Descriptive Statistics

Descriptive statistics are used to describe the basic features of the data in research, and they form the basis of quantitative analysis of data (Trochim *et al.*, 2001). In this research, the data can be divided into either nominal or ordinal, and they may be displayed using either a histogram chart or a bar chart. Although descriptive statistics help research simplify large amounts of data reasonably, they still have limitations (Trochim *et al.*, 2001). Therefore, the univariate and multivariate statistical analysis will be considered in the following paragraphs.

3.6.3 Chi-square Test

The Chi-square test is a non-parametric test determining whether the variables are independent or related (McHugh, 2013). In this research, SQ1 - age, SQ2 - gender, and SQ5 - occupation are independent variables, SQ 8 - SQ 24 are dependent

variables. The researcher intends to use Chi-Square to test statistical independence or association between two categorical variables. The researcher creates a null hypothesis (H_0) and alternative hypothesis (H_1) of the Chi-Square Test, listed in Table 5, 6, and 7.

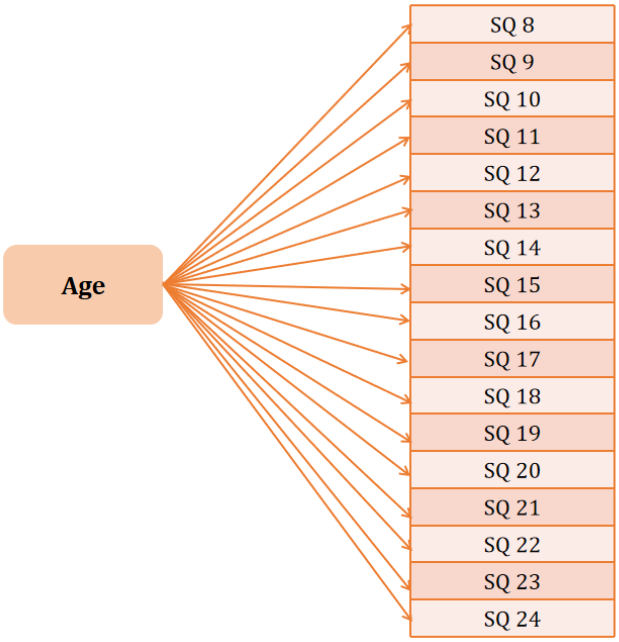

Figure 7 Independent and Dependent Variables of Chi-square Test: Age and Other Survey Questions

Table 5 Age * Survey Questions Chi-Square Test Hypothesis

Independent Variable	Survey Questions	Hypothesis
Age	SQ 8	H_0: Age is not associated with SQ 8 H_1: Age is associated with SQ 8
	SQ 9	H_0: Age is not associated with SQ 9 H_1: Age is associated with SQ 9
	SQ 10	H_0: Age is not associated with SQ 10 H_1: Age is associated with SQ 10
	SQ 11	H_0: Age is not associated with SQ 11 H_1: Age is associated with SQ 11
	SQ 12	H_0: Age is not associated with SQ 12 H_1: Age is associated with SQ 12
	SQ 13	H_0: Age is not associated with SQ 13 H_1: Age is associated with SQ 13
	SQ 14	H_0: Age is not associated with SQ 14 H_1: Age is associated with SQ 14
	SQ 15	H_0: Age is not associated with SQ 15 H_1: Age is associated with SQ 15

	SQ 16	H_0: Age is not associated with SQ 16 H_1: Age is associated with SQ 16
	SQ 17	H_0: Age is not associated with SQ 17 H_1: Age is associated with SQ 17
	SQ 18	H_0: Age is not associated with SQ 18 H_1: Age is associated with SQ 18
	SQ 19	H_0: Age is not associated with SQ 19 H_1: Age is associated with SQ 19
	SQ 20	H_0: Age is not associated with SQ 20 H_1: Age is associated with SQ 20
	SQ 21	H_0: Age is not associated with SQ 21 H_1: Age is associated with SQ 21
	SQ 22	H_0: Age is not associated with SQ 22 H_1: Age is associated with SQ 22
	SQ 23	H_0: Age is not associated with SQ 23 H_1: Age is associated with SQ 23
	SQ 24	H_0: Age is not associated with SQ 24 H_1: Age is associated with SQ 24

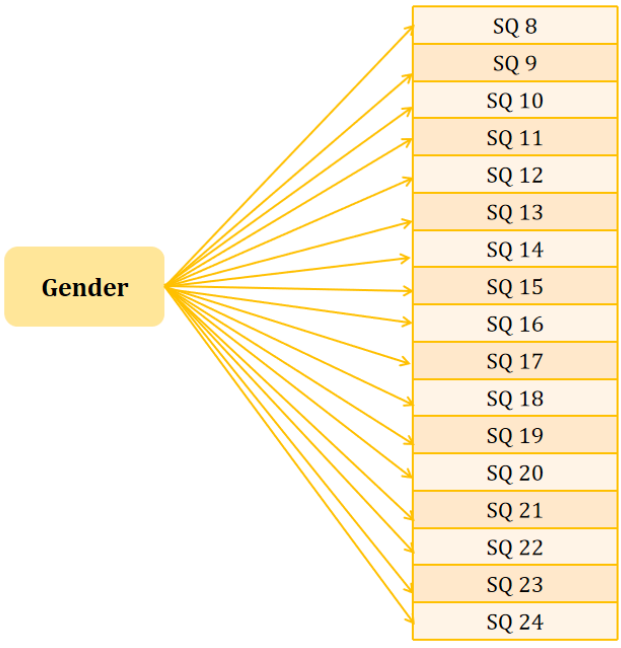

Figure 8 Independent and Dependent Variables of Chi-square Test: Gender and Other Survey Questions

Table 6 Gender * Survey Questions Chi-Square Test Hypothesis		
Independent Variable	**Survey Questions**	**Hypothesis**
Gender	SQ 8	H_0: Gender is not associated with SQ 8 H_1: Gender is associated with SQ 8
	SQ 9	H_0: Gender is not associated with SQ 9

		H_1: Gender is associated with SQ 9
	SQ 10	H_0: Gender is not associated with SQ 10 H_1: Gender is associated with SQ 10
	SQ 11	H_0: Gender is not associated with SQ 11 H_1: Gender is associated with SQ 11
	SQ 12	H_0: Gender is not associated with SQ 12 H_1: Gender is associated with SQ 12
	SQ 13	H_0: Gender is not associated with SQ 13 H_1: Gender is associated with SQ 13
	SQ 14	H_0: Gender is not associated with SQ 14 H_1: Gender is associated with SQ 14
	SQ 15	H_0: Gender is not associated with SQ 15 H_1: Gender is associated with SQ 15
	SQ 16	H_0: Gender is not associated with SQ 16 H_1: Gender is associated with SQ 16
	SQ 17	H_0: Gender is not associated with SQ 17 H_1: Gender is associated with SQ 17
	SQ 18	H_0: Gender is not associated with SQ 18 H_1: Gender is associated with SQ 18
	SQ 19	H_0: Gender is not associated with SQ 19 H_1: Gender is associated with SQ 19
	SQ 20	H_0: Gender is not associated with SQ 20 H_1: Gender is associated with SQ 20
	SQ 21	H_0: Gender is not associated with SQ 21 H_1: Gender is associated with SQ 21
	SQ 22	H_0: Gender is not associated with SQ 22 H_1: Gender is associated with SQ 22
	SQ 23	H_0: Gender is not associated with SQ 23 H_1: Gender is associated with SQ 23
	SQ 24	H_0: Gender is not associated with SQ 24 H_1: Gender is associated with SQ 24

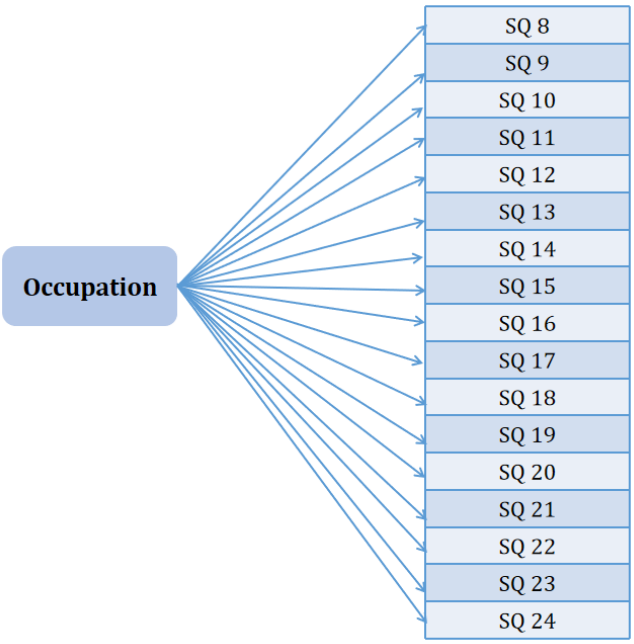

Figure 9 Independent and Dependent Variables of Chi-square Test: Occupation and Other Survey Questions

Table 7 Occupation * Survey Questions Chi-Square Test Hypothesis

Independent Variable	Survey Questions	Hypothesis
Occupation	SQ 8	H_0: Occupation is not associated with SQ 8 H_1: Occupation is associated with SQ 8
	SQ 9	H_0: Occupation is not associated with SQ 9 H_1: Occupation is associated with SQ 9
	SQ 10	H_0: Occupation is not associated with SQ 10 H_1: Occupation is associated with SQ 10
	SQ 11	H_0: Occupation is not associated with SQ 11 H_1: Occupation is associated with SQ 11
	SQ 12	H_0: Occupation is not associated with SQ 12 H_1: Occupation is associated with SQ 12
	SQ 13	H_0: Occupation is not associated with SQ 13 H_1: Occupation is associated with SQ 13
	SQ 14	H_0: Occupation is not associated with SQ 14 H_1: Occupation is associated with d SQ 14
	SQ 15	H_0: Occupation is not associated with SQ 15 H_1: Occupation is associated with SQ 15
	SQ 16	H_0: Occupation is not associated with SQ 16 H_1: Occupation is associated with SQ 16
	SQ 17	H_0: Occupation is not associated with SQ 17 H_1: Occupation is associated with d SQ 17
	SQ 18	H_0: Occupation is not associated with SQ 18 H_1: Occupation is associated with SQ 18

	SQ 19	H_0: Occupation is not associated with SQ 19 H_1: Occupation is associated with SQ 19
	SQ 20	H_0: Occupation is not associated with SQ 20 H_1: Occupation is associated with SQ 20
	SQ 21	H_0: Occupation is not associated with SQ 21 H_1: Occupation is associated with SQ 21
	SQ 22	H_0: Occupation is not associated with SQ 22 H_1: Occupation is associated with SQ 22
	SQ 23	H_0: Occupation is not associated with SQ 23 H_1: Occupation is associated with SQ 23
	SQ 24	H_0: Occupation is not associated with SQ 24 H_1: Occupation is associated with SQ 24

3.6.4 Three-way ANOVA

A three-way ANOVA is used to estimate whether there is a three-way relationship among variables on a result (Kenton, 2021). The researcher intends to use a three-way ANOVA to understand how three independent variables in combination affect a dependent variable. The group is made Age* Gender* Occupation based on three independent variables: age, gender, and occupation. The hypothesis for three-way ANOVA has been listed in Table 8.

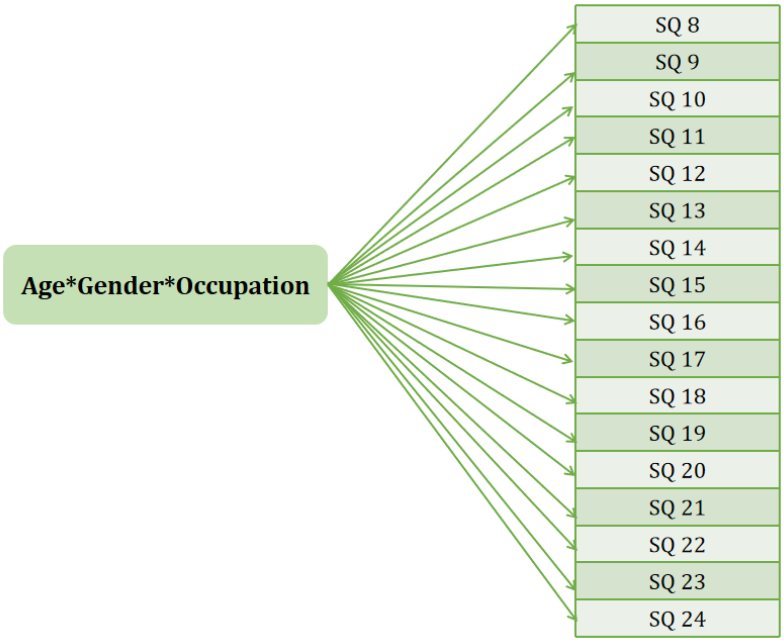

Figure 10 Three-way ANOVA Test: Age*Gender*Occupation for Survey Questions

Table 8 Age*Gender*Occupation for Survey Questions Three-way ANOVA Hypothesis		
Independent Variable	**Survey Questions**	**Hypothesis**
Age* Gender* Occupation	SQ 8	H_0: The interaction among age, gender and occupation does not affect the SQ8 H_1: The interaction among age, gender and occupation affects the SQ8
	SQ 9	H_0: The interaction among age, gender and occupation does not affect the SQ9 H_1: The interaction among age, gender and occupation affects the SQ9
	SQ 10	H_0: The interaction among age, gender and occupation does not affect the SQ10 H_1: The interaction among age, gender and occupation affects the SQ10
	SQ 11	H_0: The interaction among age, gender and occupation does not affect the SQ11 H_1: The interaction among age, gender and occupation affects the SQ11
	SQ 12	H_0: The interaction among age, gender and occupation does not affect the SQ12 H_1: The interaction among age, gender and occupation affects the SQ12
	SQ 13	H_0: The interaction among age, gender and occupation does not affect the SQ13 H_1: The interaction among age, gender and occupation affects the SQ13
	SQ 14	H_0: The interaction among age, gender and occupation does not affect the SQ14 H_1: The interaction among age, gender and occupation affects the SQ14
	SQ 15	H_0: The interaction among age, gender and occupation does not affect the SQ15 H_1: The interaction among age, gender and occupation affects the SQ15
	SQ 16	H_0: The interaction among age, gender and occupation does not affect the SQ16 H_1: The interaction among age, gender and occupation affects the SQ16
	SQ 17	H_0: The interaction among age, gender and occupation does not affect the SQ17 H_1: The interaction among age, gender and occupation affects the SQ17
	SQ 18	H_0: The interaction among age, gender and occupation does not affect the SQ18 H_1: The interaction among age, gender and occupation affects the

		SQ18
	SQ 19	H_0: The interaction among age, gender and occupation does not affect the SQ19 H_1: The interaction among age, gender and occupation affects the SQ19
	SQ 20	H_0: The interaction among age, gender and occupation does not affect the SQ20 H_1: The interaction among age, gender and occupation affects the SQ20
	SQ 21	H_0: The interaction among age, gender and occupation does not affect the SQ21 H_1: The interaction among age, gender and occupation affects the SQ21
	SQ 22	H_0: The interaction among age, gender and occupation does not affect the SQ22 H_1: The interaction among age, gender and occupation affects the SQ22
	SQ 23	H_0: The interaction among age, gender and occupation does not affect the SQ23 H_1: The interaction among age, gender and occupation affects the SQ23
	SQ 24	H_0: The interaction among age, gender and occupation does not affect the SQ24 H_1: The interaction among age, gender and occupation affects the SQ24

3.6.5 Statistical Software

Ong *et al.* (2017) demonstrated an available statistical software for data analysis, Statistical Package for Social Science (SPSS). Researchers widely use SPSS, and this software can conduct various statistical test. In this research, descriptive analysis, univariate and multivariate analysis could be undertaken using SPSS.

3.7 Limitations of the Methodology

The methodology has several limitations that are important to note. These limitations, in turn, provide directions for future research.

Firstly, this methodology only uses a quantitative approach to collect views from IT professionals. Future research could utilize mixed-method (qualitative and

quantitative) to identify more deep insights and challenges in the data visualization software domain. Future studies should do a case study or interview IT professionals to discover more critical criterion and data visualization platforms.

Secondly, the researcher uses Google Form for creating an online survey questionnaire. However, Google is blocked in mainland China (Brenkert, 2009). The participants in mainland China will only succeed to complete the survey if they have a VPN, which leads to limitation in getting feedback from Chinses IT professionals.

Thirdly, two participants provide the suggestion on survey design. Most IT professionals rarely work on a single visualization tool. So, after answering survey question 7, “Which data visualization tools do you use frequently? (Multiple choices)”, each tool should have its process to answer the following survey questions.

4. Results

In this chapter, the researcher firstly identifies the reliability of questionnaire answers and makes statistical analysis using descriptive analysis, Chi-square Test and three-way ANOVA. The results show the multiple data visualization tools used by IT professionals and their characteristics. Additionally, it also analyzes the relationships between variables. The connection between literature review, research questions and sub research questions, hypothesis and results have been shown in the final part.

4.1 Data Analysis

In this research, 502 pieces of feedback are collected. 437 participants are IT professionals, and only 388 participants are IT professionals who use data visualization tools. Therefore, 388 are valid for data analysis. In the following parts, the researcher accesses the internal consistency of questionnaire answers using Cronbach's alpha coefficient and presents results using descriptive analysis, Chi-square Test and three-way ANOVA.

4.1.1 Cronbach's Alpha

Many empirical studies use questionnaires to extract quantitative information from population samples. Before implementing statistical analysis, it is necessary to ensure that the answers are reliable. According to Leontitsis and Pagge (2007), Cronbach's alpha coefficient measures survey questions' reliability and is only for Likert scale data. Therefore, the researcher uses Cronbach's alpha coefficient to assess internal consistency for ordinal data. In this research, survey question 8, 9, 10, 11, 12, 13, 14, 17, and 24 are tested because these questions are ordinal measurement type.

The results of Cronbach's alpha analysis for ordinal data have been shown in Table 9 and Table 10.

Case Processing Summary			
		N	%
Cases	Valid	388	100.0
	Excluded [a]	0	.0
	Total	388	100.0
a. Listwise deletion based on all variables in the procedure.			

Table 9 Participants for Cronbach's Alpha

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha based on Standardized Items	N of Items
.892	.893	9

Table 10 Cronbach's Alpha for This Survey

From the results in Table 9 and Table 10, the Cronbach's Alpha is .892 that is higher than 0.70, which means these ordinal items have a high internal consistency.

4.1.2 Descriptive Analysis

Descriptive analysis is the first important phase in conducting statistical analysis. It gives an idea of data distribution and enables the identification of associations between variables so that it is helpful for further statistical analysis. The researcher uses a frequency table for each survey question and a stacked bar chart for individual survey questions with three independent variables. The following parts have shown the descriptive analysis results.

SQ 1: What is your age group?

Statistics		
SQ1_Age		
N	Valid	388
	Missing	0

Table 11 Statistics of Participants to SQ1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18 – 25	105	27.1	27.1	27.1
	26 – 35	236	60.8	60.8	87.9
	36 – 45	31	8.0	8.0	95.9
	Over 45	16	4.1	4.1	100.0
	Total	388	100.0	100.0	

Table 12 Description of Participants with all Age Groups

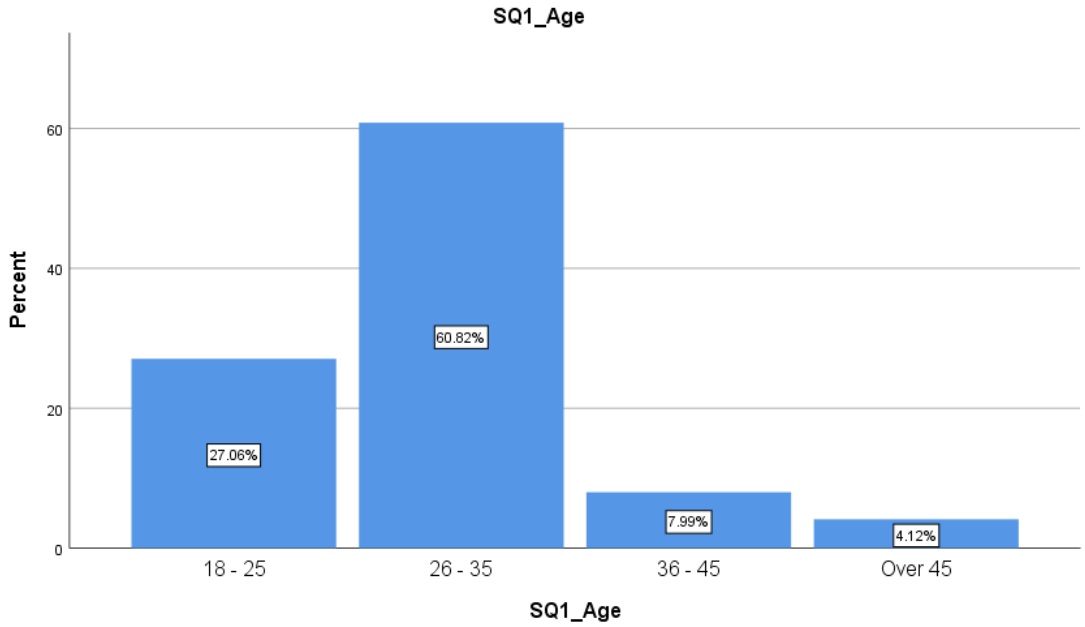

Figure 11 Bar Chart Showing the Participants with all Age Groups

Based on Table 12 and Figure 11, it can be seen that most participants within this survey are in the range of 26 to 35, which occupies 60.8%. The participants over 45 years old are less in this survey, only 4.1% of all participants.

SQ 2: What is your gender?

Statistics		
SQ2_Gender		
N	Valid	388
	Missing	0

Table 13 Statistics of Participants to SQ2

SQ2_Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	99	25.5	25.5	25.5
	Male	287	74.0	74.0	99.5
	Prefer not to say	2	.5	.5	100.0
	Total	388	100.0	100.0	

Table 14 Description of Participants with Different Gender Groups

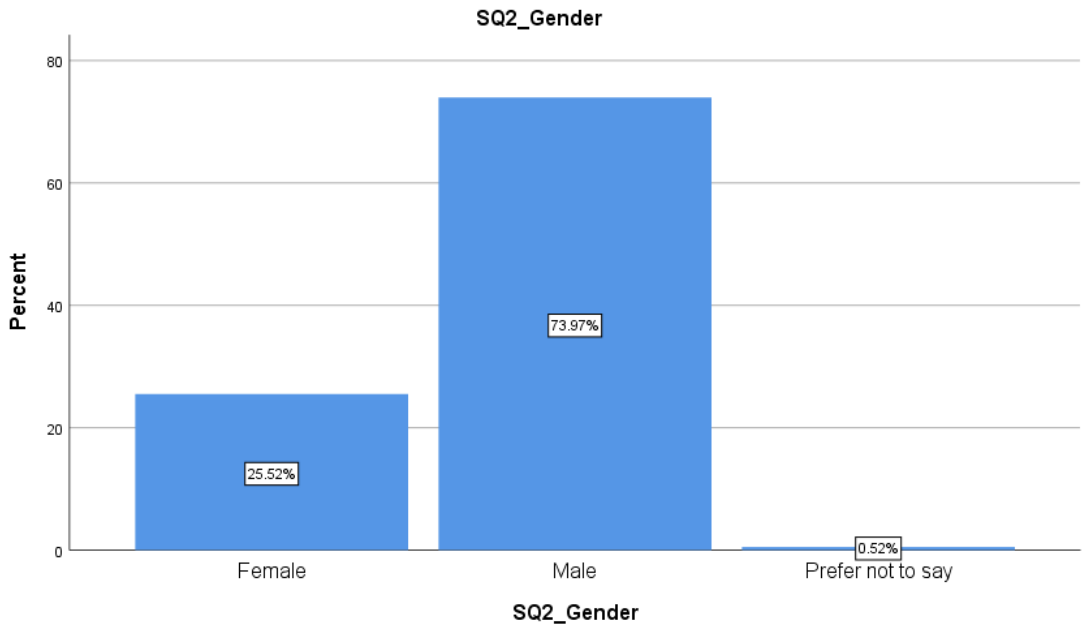

Figure 12 Bar Chart Showing the Participants with Different Gender Groups

Table 13 and Figure 12 display that 74% of participants are male, and 25.5% are female. Male participants within this survey questionnaire nearly three times more than female. Only two participants choose “prefer not to say”.

SQ 3: What is your educational level?

Statistics		
SQ3		
N	Valid	388
	Missing	0

Table 15 Statistics of Participants to SQ3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bachelor Degree	199	51.3	51.3	51.3
	Graduate Diploma	28	7.2	7.2	58.5
	Master Degree	111	28.6	28.6	87.1
	Microsoft and other IT industry certification	1	.3	.3	87.4
	Na	1	.3	.3	87.6
	No university degree	1	.3	.3	87.9
	PhD	4	1.0	1.0	88.9
	Postgraduate Diploma	42	10.8	10.8	99.7
	Studying for an honor in computer science and data analytics	1	.3	.3	100.0
	Total	388	100.0	100.0	

Table 16 Description of Participants with Different Educational Level

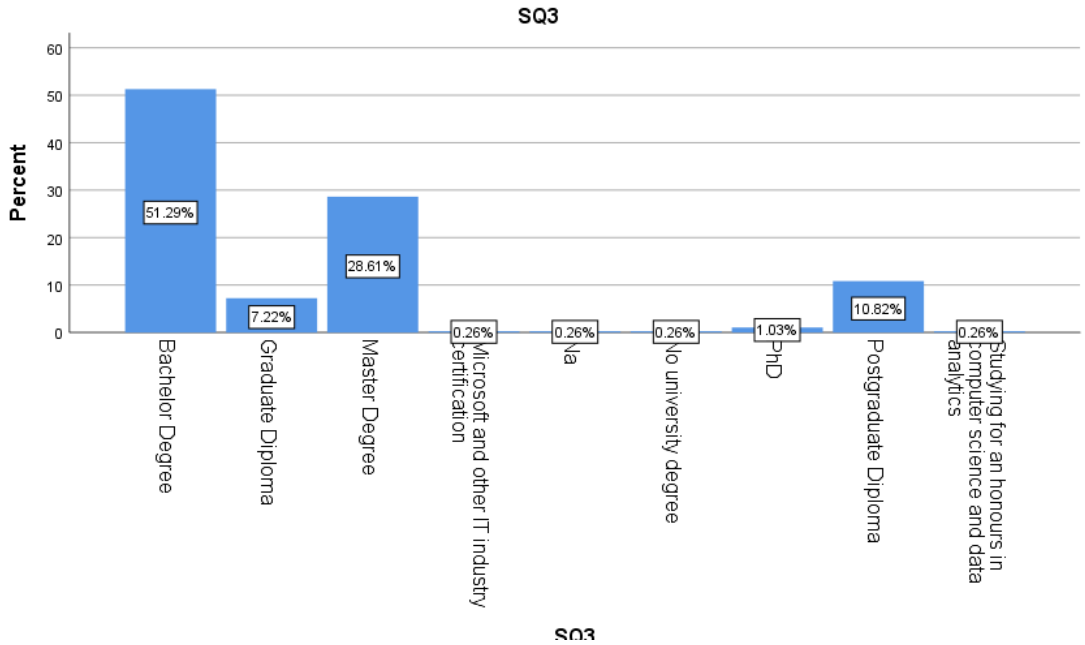

Figure 13 Bar Chart Showing the Participants with Different Educational Level

According to Table 16 and Figure 13, 51.3% of participants have Bachelor Degree,

and 28.6% of participants have Master Degree. The participants hold Graduate Diploma, Postgraduate Diploma and PhD at a low rate, and they are 7.2%, 10.8% and 1.0%, respectively. In addition to the options given, some participants do not specify their qualifications or mentioned that they obtained some other professional certificate.

SQ 4: Are you an IT professional?

Statistics		
SQ4		
N	Valid	388
	Missing	0

Table 17 Statistics of Participants to SQ4

SQ4					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	388	100.0	100.0	100.0

Table 18 Description of Participants who are IT Professionals

SQ 5: What's your occupation?

Statistics		
SQ5_Occupation		
N	Valid	388
	Missing	0

Table 19 Statistics of Participants to SQ5

SQ5_Occupation					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Experienced IT worker	311	80.2	80.2	80.2
	Tertiary IT learner	77	19.8	19.8	100.0
	Total	388	100.0	100.0	

Table 20 Description of Participants with Different Occupations

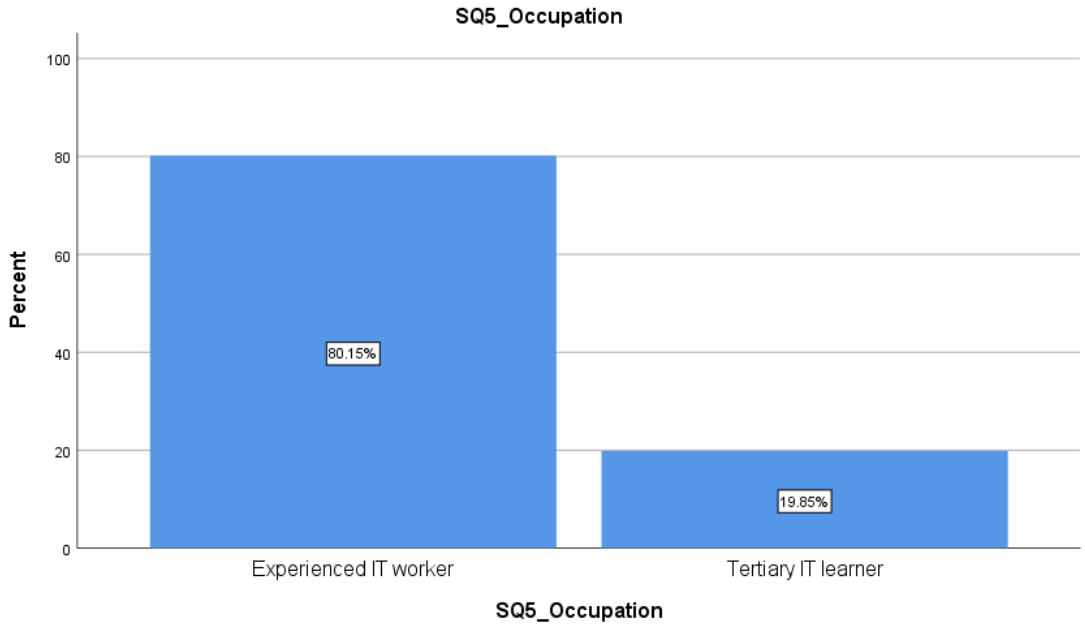

Figure 14 Bar Chart Showing the Participants with Different Occupations

SQ 6: Do you use data visualization tools?

Statistics		
SQ6		
N	Valid	388
	Missing	0

Table 21 Statistics of Participants to SQ6

SQ6					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	388	100.0	100.0	100.0

Table 22 Description of Participants Who Use Data Visualization Tools

Table 18 proves that all the participants are IT professionals. Based on that, Figure 14 reflects the proportion of experienced IT worker is 80.2%, and only 19.8% of participants are tertiary IT learner. The experienced IT worker is more than four times than tertiary IT learner approximately.

Table 22 illustrates all participants use data visualization tools in their daily life and work. Therefore, the answers to these questions ensured that all participants were IT people who regularly use data visualization tools. All participants matched the target research group for the topic of this study.

SQ 7: Which data visualization tools do you use frequently?

Case Summary						
	Valid		Cases Missing		Total	
	N	Percent	N	Percent	N	Percent
Data Visualization Tools Given Options [a]	388	100.0%	0	0.0%	388	100.0%
Other Data Visualization Tools [a]	52	13.4%	336	86.6%	388	100.0%
a. Dichotomy group tabulated at value 1.						

Table 23 Case Summary of Participants to SQ7

		Responses		Percent of Cases
		N	Percent	
Data Visualization Tools Given Options Used [a]	SQ7_Tableau	184	21.1%	47.4%
	SQ7_Microsoft_Power_BI	264	30.3%	68.0%
	SQ7_Fusion_Charts	7	0.8%	1.8%
	SQ7_Chart.js	27	3.1%	7.0%
	SQ7_Qlikview	30	3.4%	7.7%
	SQ7_Sisense	5	0.6%	1.3%
	SQ7_Google_Analytics	72	8.3%	18.6%
	SQ7_Excel	233	26.7%	60.1%
	SQ7_Others	50	5.7%	12.9%
Total		872	100.0%	224.7%
a. Dichotomy group tabulated at value 1.				

Table 24 Frequency of Data Visualization Tools Used by Participants

		Responses		Percent of Cases
		N	Percent	
Other Data Visualization Tools Used [a]	SQ7_Others_QlikSense	6	9.4%	11.5%
	SQ7_Others_SSRS	7	10.9%	13.5%
	SQ7_Others_Data_Studio	4	6.3%	7.7%
	SQ7_Others_D3.js	4	6.3%	7.7%
	SQ7_Others_Hubspot	1	1.6%	1.9%
	SQ7_Others_Business_Objects	1	1.6%	1.9%
	SQ7_Others_Google_Spreadsheets	2	3.1%	3.8%
	SQ7_Others_IBM	1	1.6%	1.9%
	SQ7_Others_Pentaho_BI_Suite	1	1.6%	1.9%
	SQ7_Others_Kibana	1	1.6%	1.9%
	SQ7_Others_E_Chart	1	1.6%	1.9%
	SQ7_Others_High_Chart	1	1.6%	1.9%

	SQ7_Others_LibreOffice_Calculation	1	1.6%	1.9%
	SQ7_Others_SAP_Analytic_Cloud	1	1.6%	1.9%
	SQ7_Others_Msbi	1	1.6%	1.9%
	SQ7_Others_Service_Now	1	1.6%	1.9%
	SQ7_Others_Weka	2	3.1%	3.8%
	SQ7_Others_IBM_Cognos	2	3.1%	3.8%
	SQ7_Others_MySQL	1	1.6%	1.9%
	SQ7_Others_Python	3	4.7%	5.8%
	SQ7_Others_Looker	1	1.6%	1.9%
	SQ7_Others_Matplotlib	2	3.1%	3.8%
	SQ7_Others_Seaborn	1	1.6%	1.9%
	SQ7_Others_SAS_VA	1	1.6%	1.9%
	SQ7_Others_Visme	1	1.6%	1.9%
	SQ7_Others_ArcGIS	1	1.6%	1.9%
	SQ7_Others_Grafana	1	1.6%	1.9%
	SQ7_Rstudio_Shiny	1	1.6%	1.9%
	SQ7_Others_Domo	1	1.6%	1.9%
	SQ7_Others_Splunk	1	1.6%	1.9%
	SQ7_Others_Kendo_Charts	1	1.6%	1.9%
	SQ7_Others_Vega	1	1.6%	1.9%
	SQ7_Others_Vega_lite	1	1.6%	1.9%
	SQ7_Others_Datadog	1	1.6%	1.9%
	SQ7_Others_Azure	1	1.6%	1.9%
	SQ7_Others_OBIEE	1	1.6%	1.9%
	SQ7_Others_Sap_bo	1	1.6%	1.9%
	SQ7_Others_spotfire	2	3.1%	3.8%
	SQ7_Others_In_House	1	1.6%	1.9%
	SQ7_Microsoft_Enterprise_Reporting	1	1.6%	1.9%
Total		64	100.0%	123.1%
a. Dichotomy group tabulated at value 1.				

Table 25 Frequency of Other Data Visualization Tools Used by Participants

According to Table 23, all participants answer SQ7, and 13.4% of participants provide other data visualization tools they frequently used in addition to the given options.

Table 24 shows the frequency of given options of data visualization tools used by IT professionals. The most significant number of people (30.3%) used Microsoft Power BI, followed by the traditional data visualization tool Excel (26.7%). Tableau in third place, with 184 people choosing it (21.1%).

Table 25 reflects the other data visualization tools, in addition to the given options, were frequently used by these participants. Of these, SSRS is used most often (10.9%), followed by Qlik Sense at 9.4%. Data Studio and D3.js tied for third place, both at 6.3%.

SQ 8 How easy is it to install and configure the data visualization tools that you use? (Related to user interface)

Statistics		
SQ8		
N	Valid	388
	Missing	0

Table 26 Statistics of Participants to SQ8

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 Mostly dissatisfied	2	.5	.5	.5
	3 Neutral	34	8.8	8.8	9.3
	4 Mostly satisfied	149	38.4	38.4	47.7
	5 Completely satisfied	203	52.3	52.3	100.0
	Total	388	100.0	100.0	

Table 27 Frequency of Participants Concern about it is Easy to Install and Configure DVT

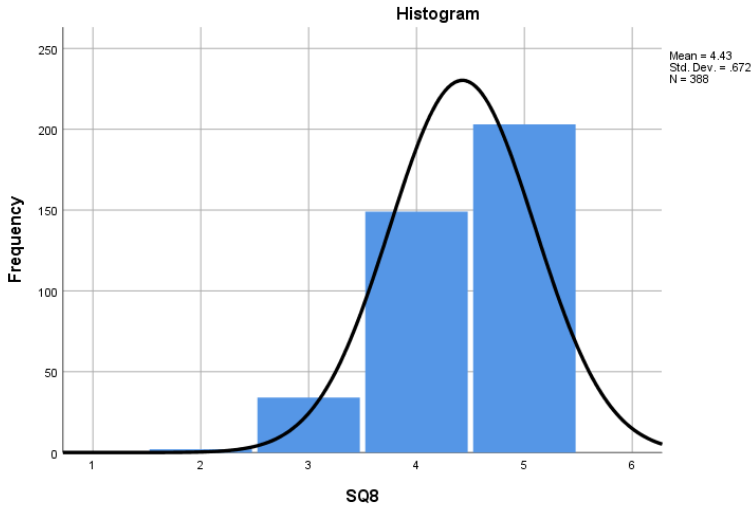

Figure 15 Histogram Chart Showing the Level of Participants Think about it is Easy to Install and Configure

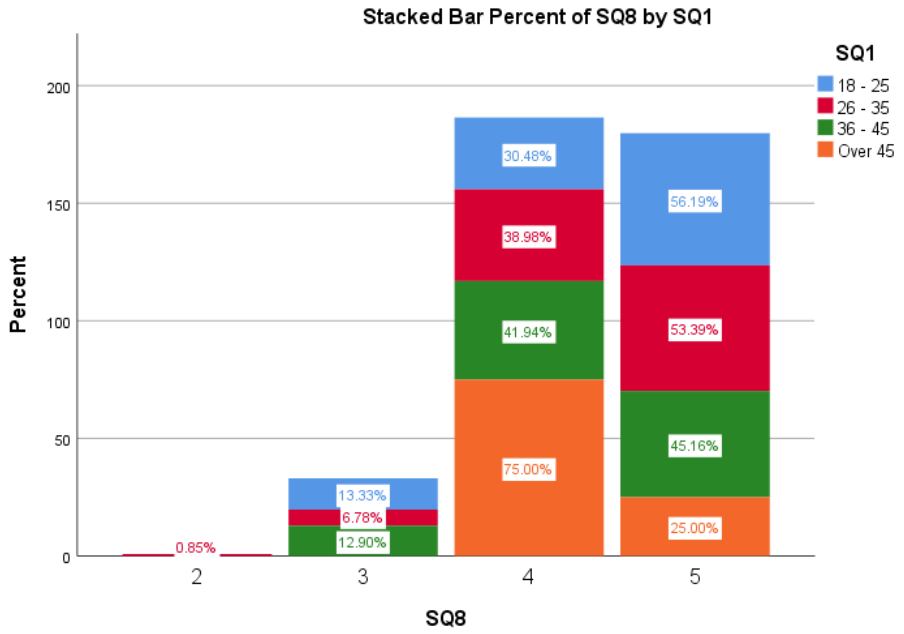

Figure 16 Stacked Bar Percent of SQ8 by SQ1_Age

Figure 17 Stacked Bar Percent of SQ8 by SQ1_Age

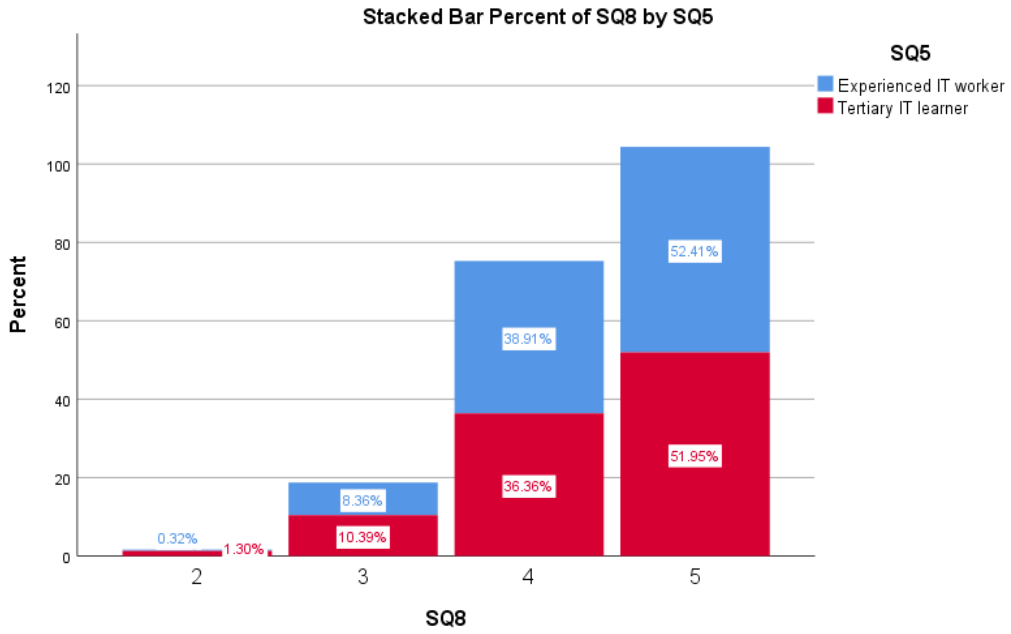

Figure 18 Stacked Bar Percent of SQ8 by SQ5_Occupation

According to Table 27 and Figure 15, 52.3% of participants choose “Completely satisfied”, and 38.4% of participants choose “Mostly satisfied”. The remaining 8.8% of participants choose “Neutral”, and only 0.5% prefer “Mostly dissatisfied”. Therefore, most IT professionals (90.7%) think the data visualization tools they used are easy to install and configure.

Figure 16 shows 56.19% of participants in the 18-25 and 53.39% of people in the 26-35 age groups choose “Completely satisfied”, the 75% of people aged over 45 choose “Mostly satisfied” and only a small number of people, at the age of 26-35, select “Mostly dissatisfied”.

According to Figure 17, 60.61% of females choose “Completely satisfied”, and only 2.02% of females choose “Mostly dissatisfied”. The majority of the male are distributed between the “Completely satisfied” and “Mostly satisfied” options, at 49.48% and 40.42%, respectively.

In Figure 18, most experienced IT workers and tertiary IT students opt for “Completely satisfied” and “Mostly satisfied”. Only a tiny percentage of skilled IT workers and tertiary IT students choose “Mostly dissatisfied”.

SQ 9 How easy is it to navigate through the data visualization tool that you use? (Related to user interface)

Statistics		
SQ9		
N	Valid	388
	Missing	0

Table 28 Statistics of Participants to SQ9

SQ9					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Completely dissatisfied	1	.3	.3	.3
	2 Mostly dissatisfied	5	1.3	1.3	1.5
	3 Neutral	41	10.6	10.6	12.1
	4 Mostly satisfied	159	41.0	41.0	53.1
	5 Completely satisfied	182	46.9	46.9	100.0
	Total	388	100.0	100.0	

Table 29 Frequency of Participants Concern about it is Easy to Navigate through DVT

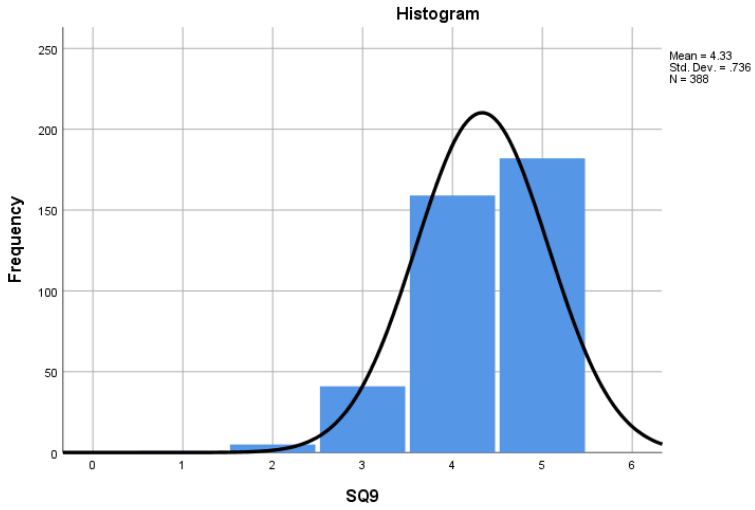

Figure 19 Histogram Chart Showing the Level of Participants Think about it is Easy to Navigate

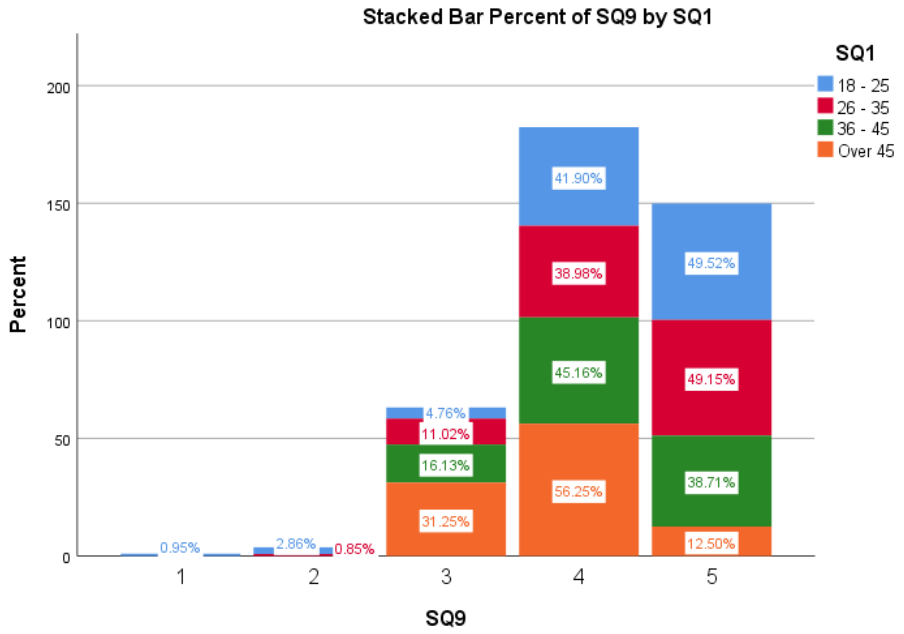

Figure 20 Stacked Bar Percent of SQ9 by SQ1_Age

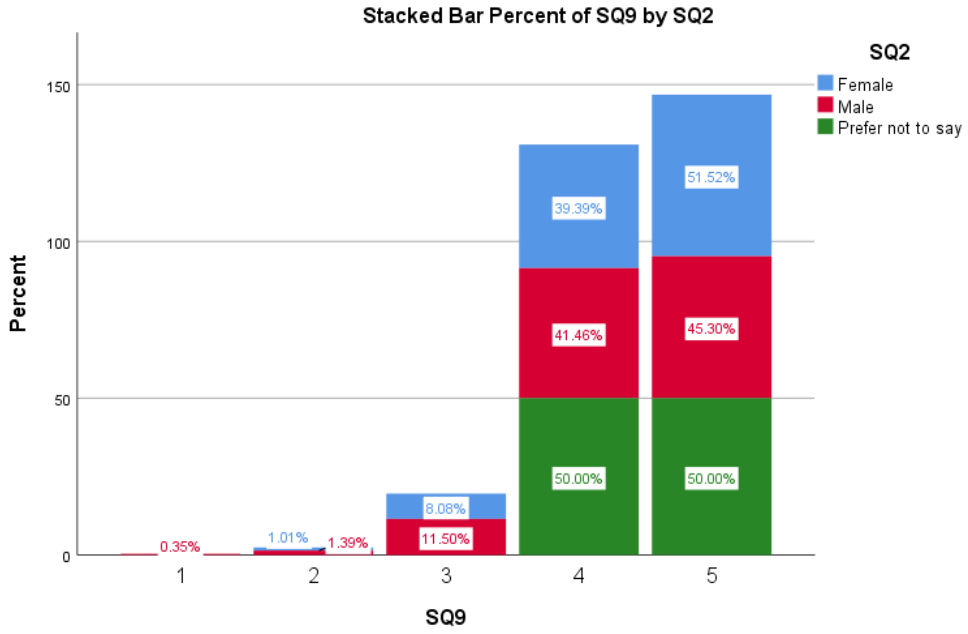

Figure 21 Stacked Bar Percent of SQ9 by SQ2_Gender

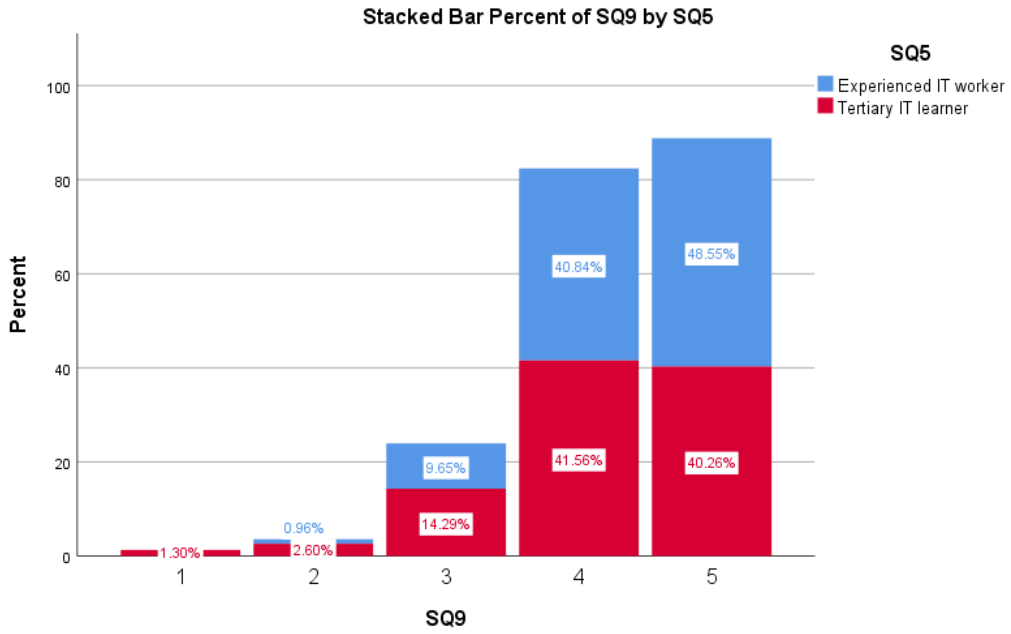

Figure 22 Stacked Bar Percent of SQ9 by SQ5_Occupation

According to Table 29 and Figure 19, 46.9% of the participants choose “Completely satisfied”, and 41% prefer “Mostly satisfied”. In addition, 10.6% choose “Neutral”, 1.3% choose “Mostly dissatisfied” and only 0.3% choose “Completely dissatisfied”. Therefore, most IT professionals (87.9%) think it is easy to navigate through the data visualization tools they used.

Figure 20 indicates most participants in the age groups 18-25 and 26-35 choose “Completely satisfied”, 49.52% and 49.15%, respectively. The majority of participants over 45 years of age choose “Neutral” and “Mostly satisfied”. Exceptionally only 0.95% of people aged 18-25 choose “Completely dissatisfied”, and 2.86% of people aged 18-25 select “Mostly dissatisfied”.

Figure 21 shows that more females than males choose “Completely satisfied”, and a similar proportion of males and females choose “Mostly satisfied”, at 41.46% and 39.39%, respectively. A small proportion of people choose “Mostly dissatisfied” and “Neutral”. Only 0.35% of males choose “Completely dissatisfied”.

Figure 22 reflects that most experienced IT workers choose “Mostly satisfied” and “Completely satisfied”, 40.84% and 48.55%, respectively. Only 0.96% of IT workers

choose “Mostly dissatisfied”. The majority of tertiary IT learners also choose “Mostly satisfied” and “Completely satisfied”. However, a small number of IT learners choose “Neutral”, “Mostly dissatisfied”, and “Completely dissatisfied”.

SQ 10 How easy is it to find specific commands in the data visualization tools that you use? (Related to user interface)

Statistics		
SQ10		
N	Valid	388
	Missing	0

Table 30 Statistics of Participants to SQ10

SQ10					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 Mostly dissatisfied	9	2.3	2.3	2.3
	3 Neutral	81	20.9	20.9	23.2
	4 Mostly satisfied	164	42.3	42.3	65.5
	5 Completely satisfied	134	34.5	34.5	100.0
	Total	388	100.0	100.0	

Table 31 Frequency of Participants Concern about it is Easy to Find Specific Commands in DVT

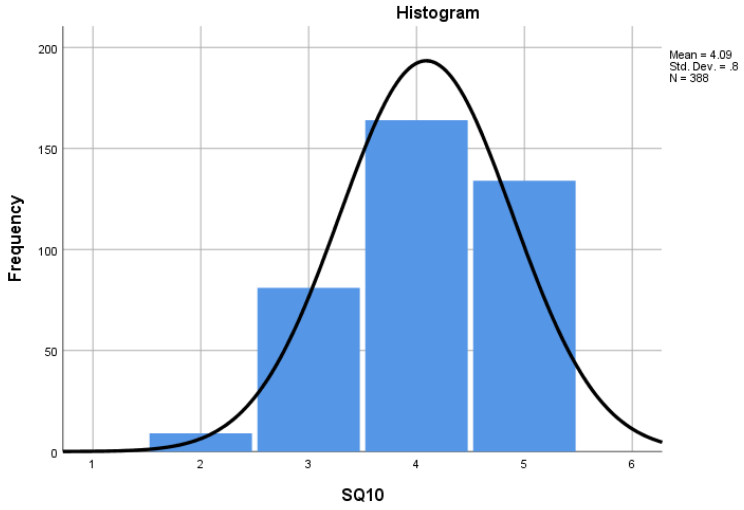

Figure 23 Histogram Chart Showing the Level of Participants Think about it is Easy to Find Specific Commands

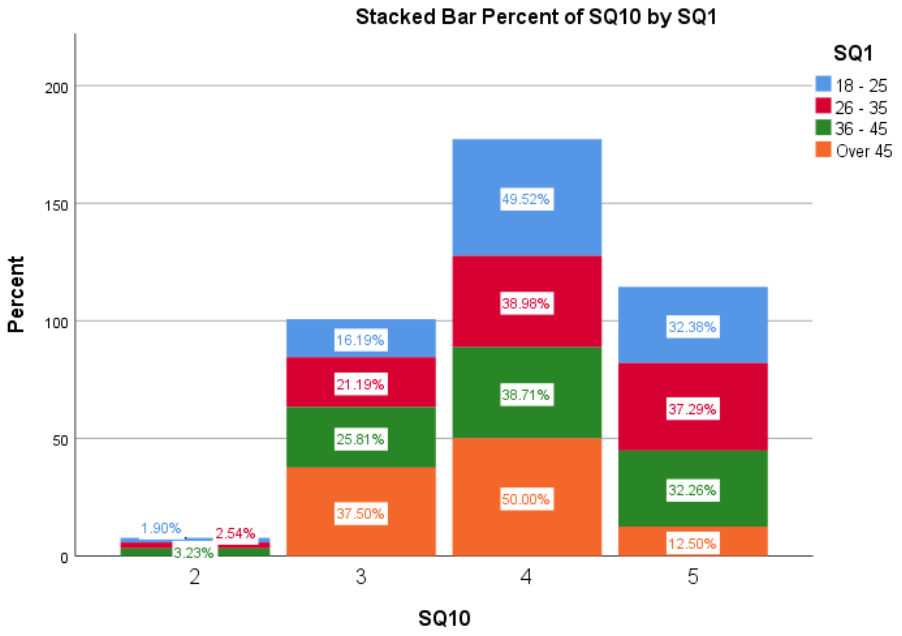

Figure 24 Stacked Bar Percent of SQ10 by SQ1_Age

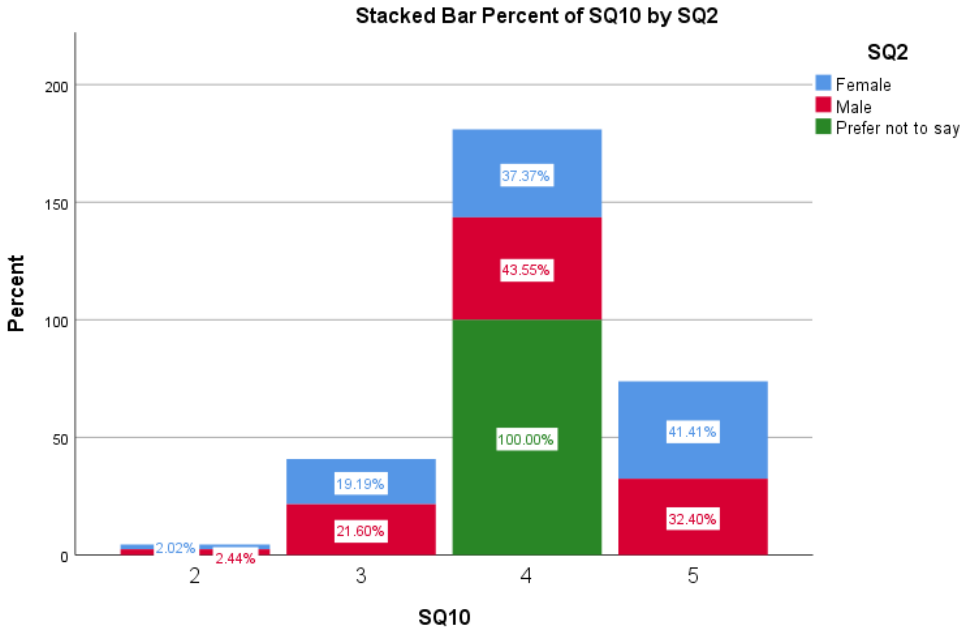

Figure 25 Stacked Bar Percent of SQ10 by SQ2_Gender

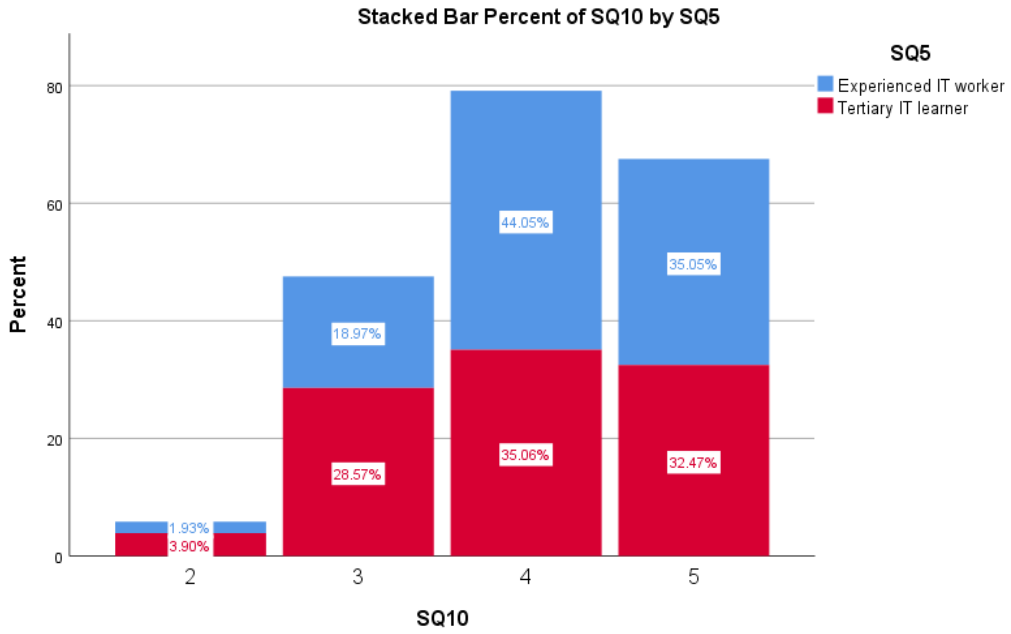

Figure 26 Stacked Bar Percent of SQ10 by SQ5_Occupation

According to Table 31 and Figure 23, the majority of the participants' choices are "Neutral", "Mostly satisfied", and "Completely satisfied". Of these, 34.5% choose "Completely satisfied", 42.3% choose "Mostly satisfied" and 20.9% choose "Neutral". The remaining 2.3% were "Mostly dissatisfied". Therefore, 76.8% of participants think it is easy to find specific commands in the data visualization tools they used.

Figure 24 shows that most people aged 26-35 (37.29%) choose "Completely satisfied", and almost the same number of people aged 18-25 and 36-45 choose "Completely satisfied" as well. The majority of participants aged 18-25 and over 45 years selected "Mostly satisfied", at 49.52% and 50.00%, respectively. Across all age groups, the most significant number of participants aged 45+ selected "Neutral". Only a tiny proportion of participants aged 18-25, 26-35 and 36-45 are "Mostly dissatisfied".

Figure 25 reflects that 41.41% of females choose "Completely satisfied", which is more than male. While more men than women choose "Mostly satisfied". A similar number of males and females selected "Neutral".

Figure 26 shows that most experienced IT workers choose "Completely satisfied" and

"Mostly Satisfied", at 35.05% and 44.05%, respectively. Tertiary IT learners mainly choose "Completely satisfied", "Mostly satisfied", and "Neutral", at 32.47%, 35.06% and 28.57%, respectively. More IT workers choose "Completely satisfied" and "Mostly satisfied" than IT learners. More IT learners to select "Neutral" than experienced IT workers.

SQ 11 How easy is it to work with multiple tables in the data visualization tools that you use? (Related to user interface)

Statistics		
SQ11		
N	Valid	388
	Missing	0

Table 32 Statistics of Participants to SQ11

SQ11					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 Mostly dissatisfied	9	2.3	2.3	2.3
	3 Neutral	62	16.0	16.0	18.3
	4 Mostly satisfied	158	40.7	40.7	59.0
	5 Completely satisfied	159	41.0	41.0	100.0
	Total	388	100.0	100.0	

Table 33 Frequency of Participants Concern about it is Easy to Work with Multiple Tables in DVT

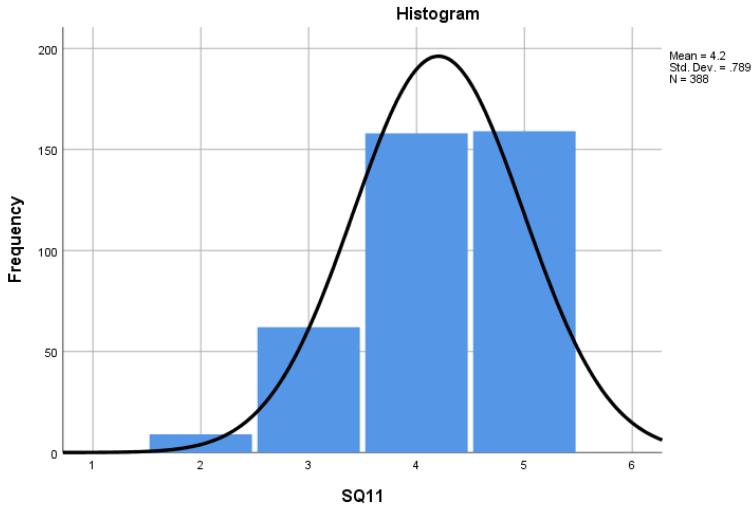

Figure 27 Histogram Chart Showing the Level of Participants Think about it is Easy to Work with Multiple Tables in DVT

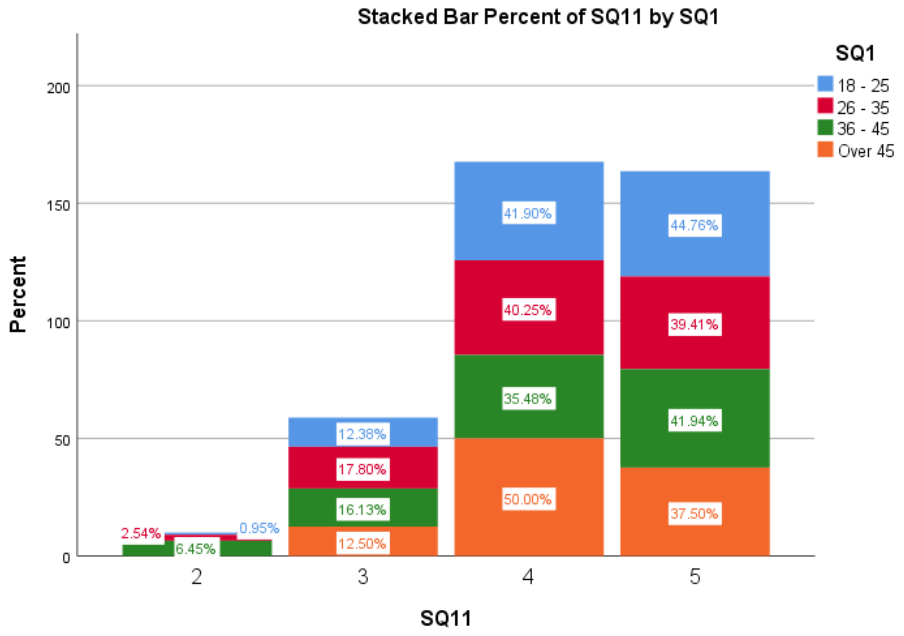

Figure 28 Stacked Bar Percent of SQ11 by SQ1_Age

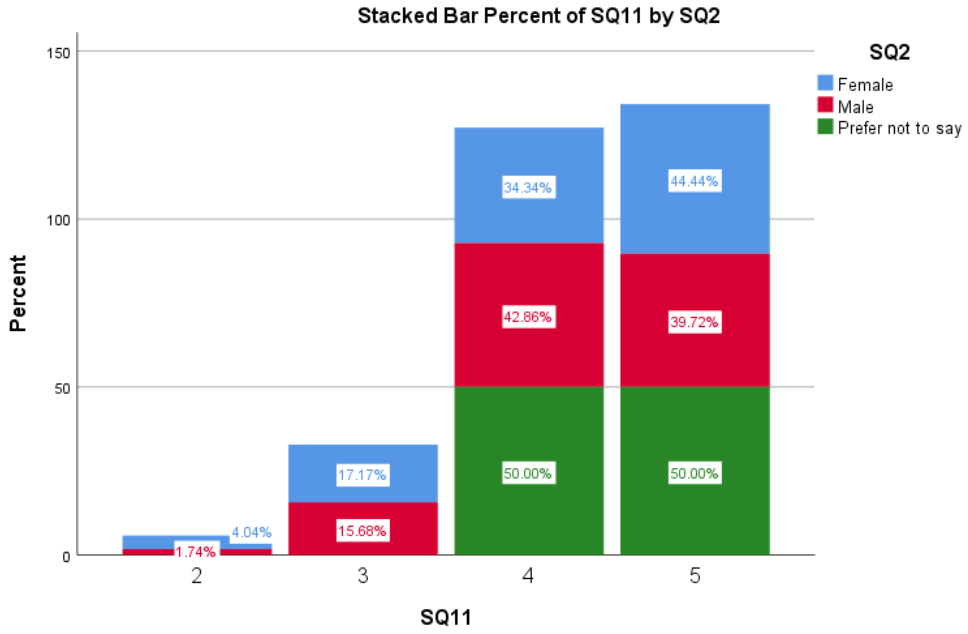

Figure 29 Stacked Bar Percent of SQ11 by SQ2_Gender

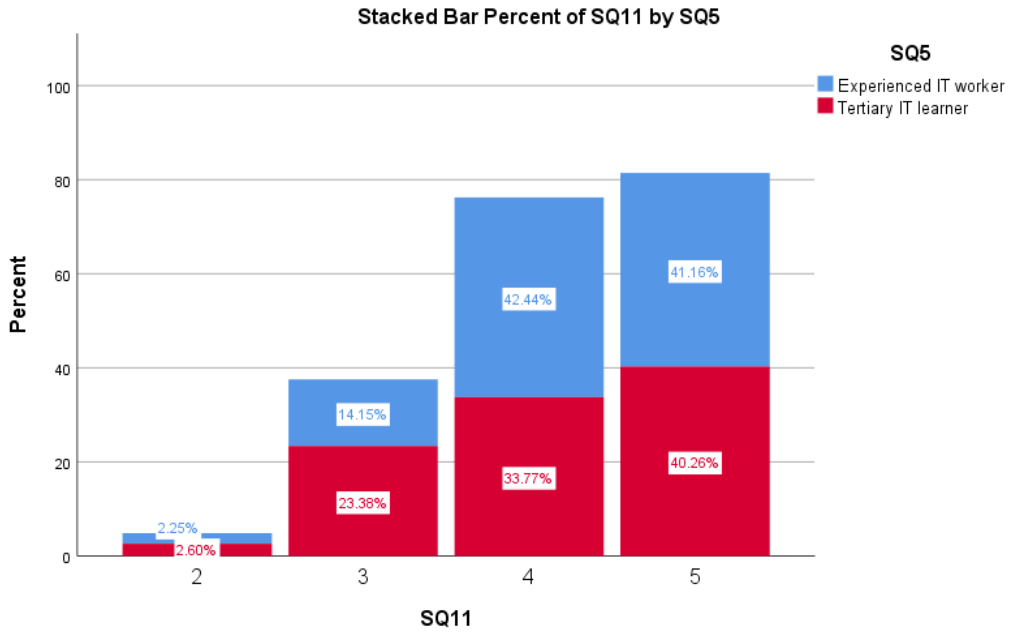

Figure 30 Stacked Bar Percent of SQ11 by SQ5_Occupation

Table 33 and Figure 27 show that almost equal numbers of participants select "Completely satisfied" and "Mostly satisfied" at 41% and 40.7%, respectively. 16% of participants prefer "Neutral", and 2.3% choose "Mostly dissatisfied". Hence, 81.7% of participants think it is easy to work with multiple tables in data visualization tools.

Figure 28 reveals the number of participants who choose "Completely satisfied" and "Neutral" is similar across all age groups. The majority of participants over the age of 45 choose "Mostly satisfied" at 50.00%. Only those in the 18-25, 26-35 and 36-45 age groups choose "Mostly dissatisfied" in a tiny number.

Figure 29 indicates more female choose "Completely satisfied" and more males choose "Mostly satisfied". The exact number of men and women choose "Neutral", and more female choose "Mostly dissatisfied".

According to Figure 30, most experienced IT workers choose "Completely satisfied" and "Mostly satisfied", at 41.16% and 42.44%, respectively. Most tertiary IT learners choose "Completely satisfied", "Mostly satisfied", and "Neutral". A small number of IT workers and IT learners are "Mostly satisfied".

SQ 12 How easy is it to visualize data into graphs in the data visualization tools that you use? (Related to user interface)

Statistics		
SQ12		
N	Valid	388
	Missing	0

Table 34 Statistics of Participants to SQ12

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 Mostly dissatisfied	9	2.3	2.3	2.3
	3 Neutral	35	9.0	9.0	11.3
	4 Mostly satisfied	131	33.8	33.8	45.1
	5 Completely satisfied	213	54.9	54.9	100.0
	Total	388	100.0	100.0	

Table 35 Frequency of Participants Concern about it is Easy to Visualize Data into Graphs in DVT

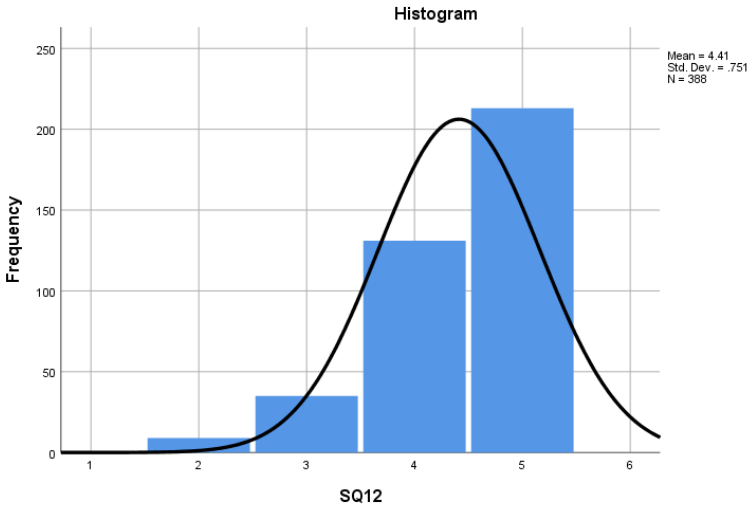

Figure 31 Histogram Chart Showing the Level of Participants Think about it is Easy to Visualize Data into Graphs in DVT

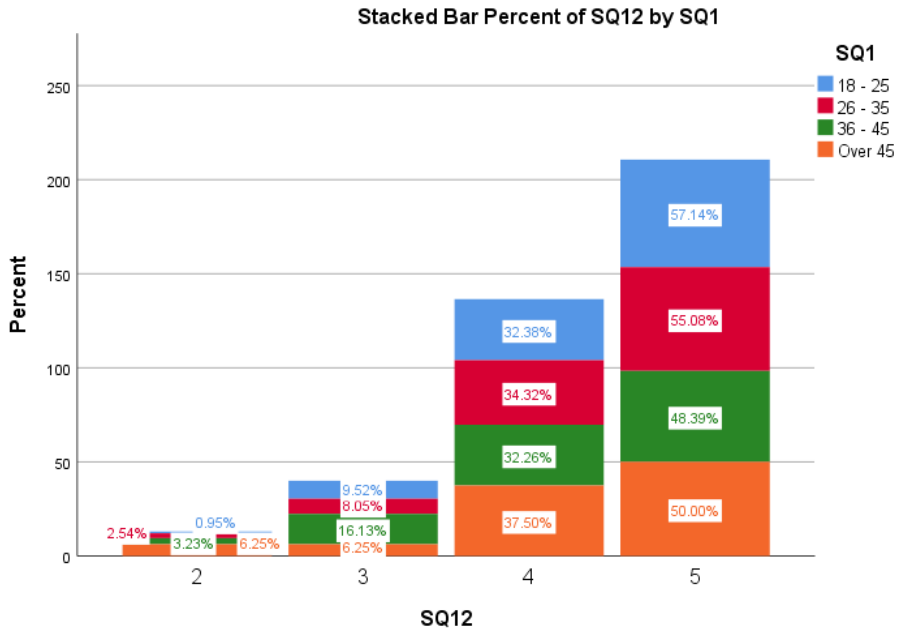

Figure 32 Stacked Bar Percent of SQ12 by SQ1_Age

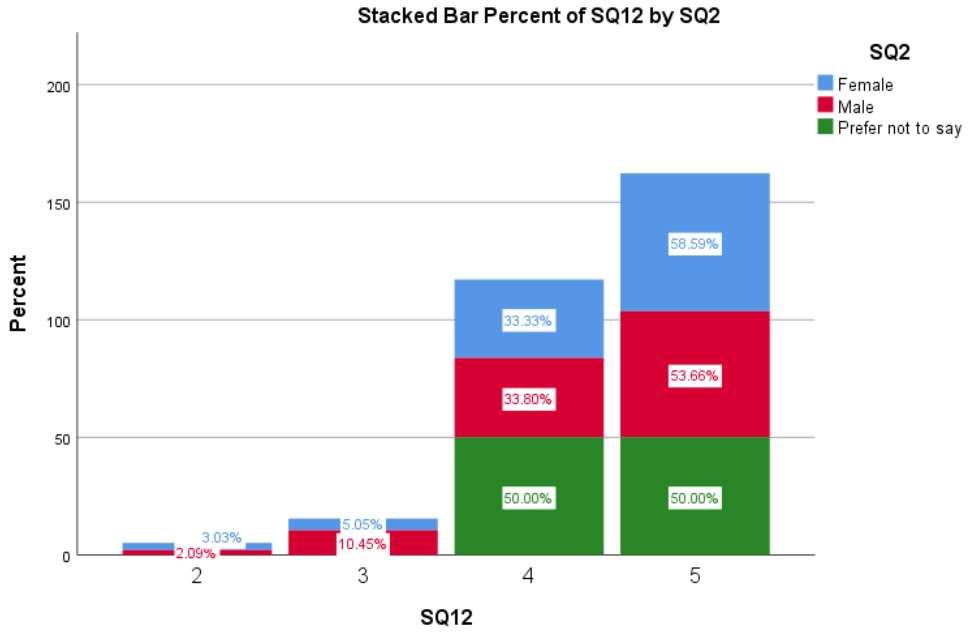

Figure 33 Stacked Bar Percent of SQ12 by SQ2_Gender

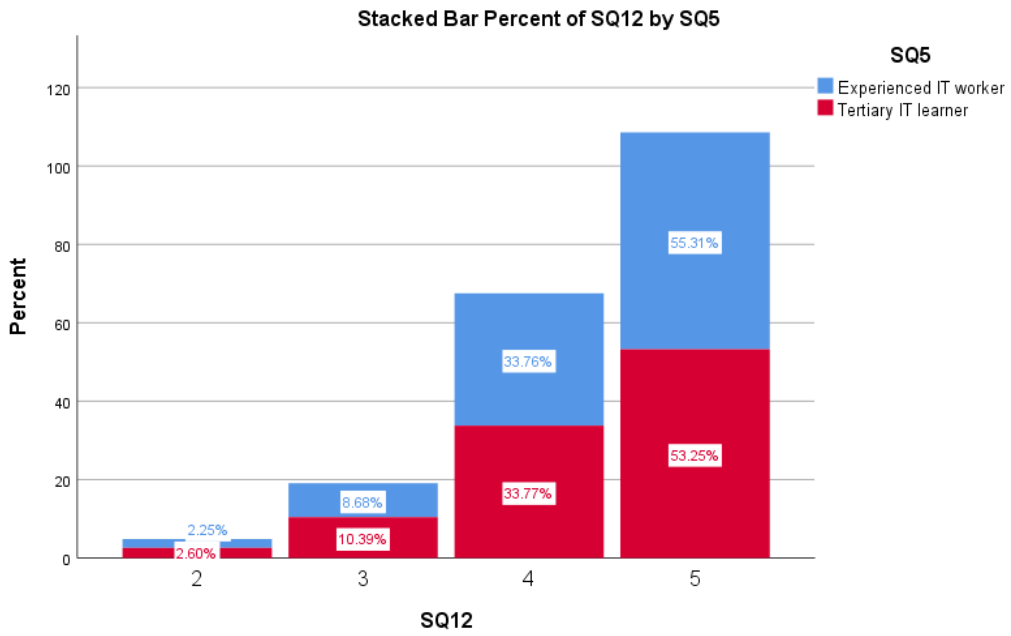

Figure 34 Stacked Bar Percent of SQ12 by SQ5_Occupation

According to Table 35 and Figure 31, 54.9% of participants choose “Completely satisfied”, and 33.8% choose “Mostly satisfied”. Therefore, most IT professionals (88.7%) think it is easy to visualize data into graphs in the data visualization tools they used. Other 9.0% choose “Neutral” and only 2.3% believe “Mostly dissatisfied”.

Figure 32 indicates most people in all age groups choose “Completely satisfied”, followed by “Mostly satisfied”. According to Figure 33, both male and female are inclined to be “Completely satisfied” at 58.59% and 53.66%, respectively. Figure 34 shows that both experienced IT workers and tertiary IT learners cover these four options. Compare with IT learners, more IT workers felt “Completely satisfied”.

SQ 13 How easy is it extract/import data from data sources in the data visualization tools that you use? (Related to data source connection)

Statistics		
SQ13		
N	Valid	388
	Missing	0

Table 36 Statistics of Participants to SQ13

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 Mostly dissatisfied	8	2.1	2.1	2.1
	3 Neutral	47	12.1	12.1	14.2
	4 Mostly satisfied	119	30.7	30.7	44.8
	5 Completely satisfied	214	55.2	55.2	100.0
	Total	388	100.0	100.0	

Table 37 Frequency of Participants Concern about it is Easy to Import Data from Data Sources in DVT

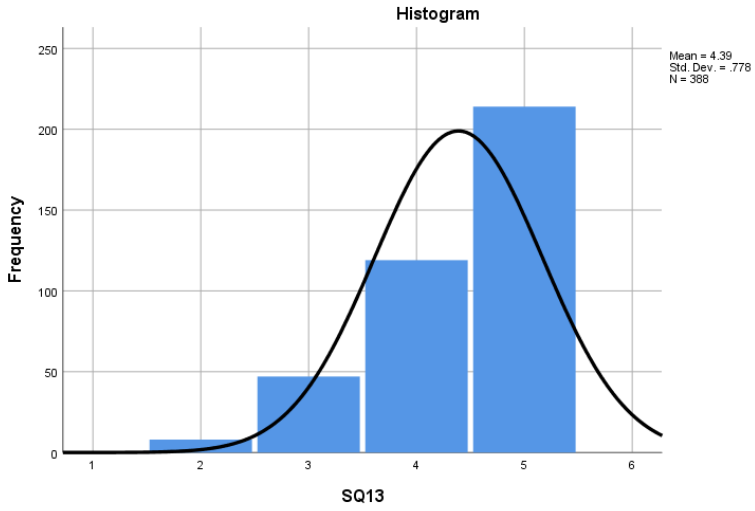

Figure 35 Histogram Chart Showing the Level of Participants Think about it is Easy to Import Data from Data Sources in DVT

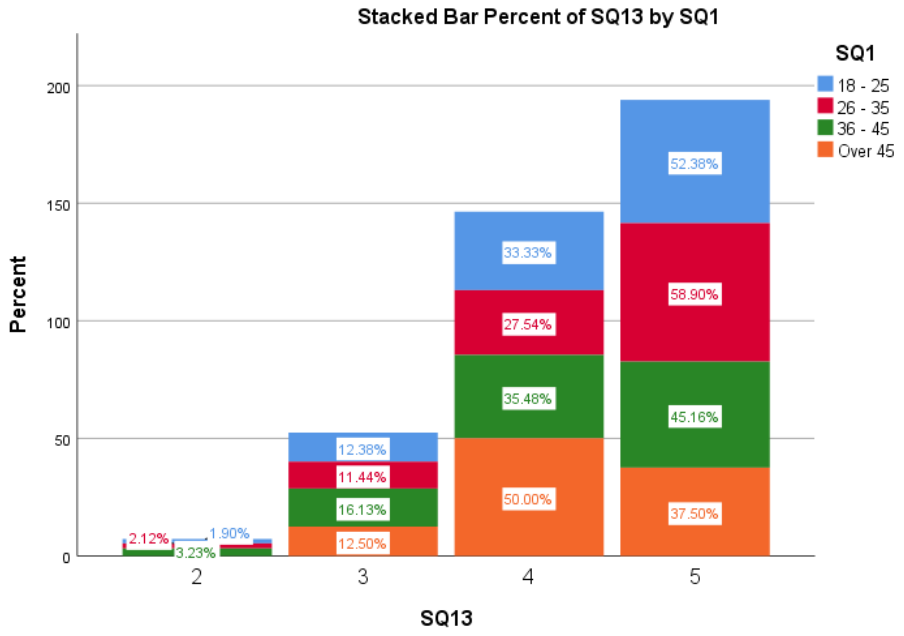

Figure 36 Stacked Bar Percent of SQ13 by SQ1_Age

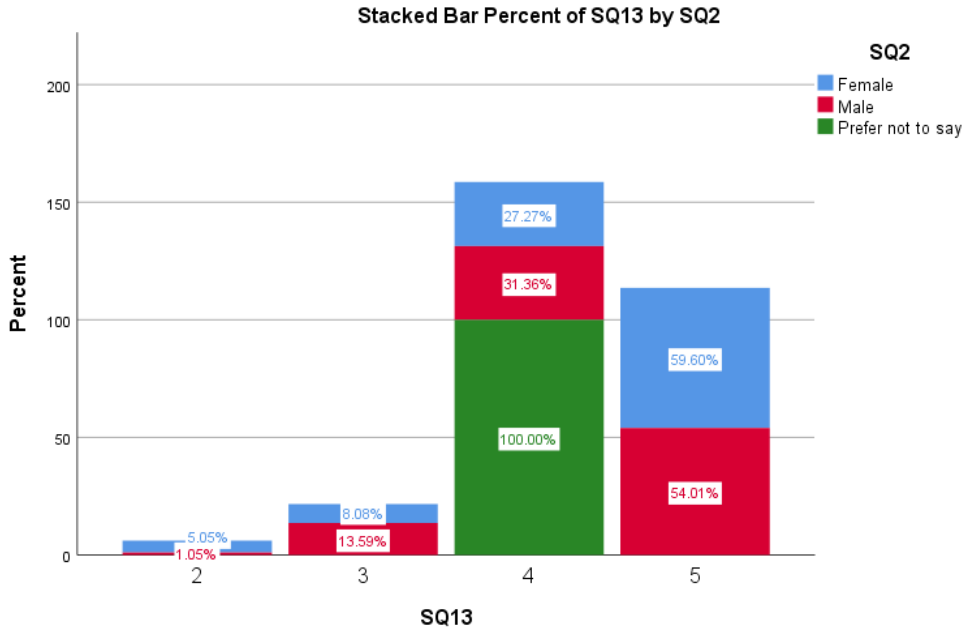

Figure 37 Stacked Bar Percent of SQ13 by SQ2_Gender

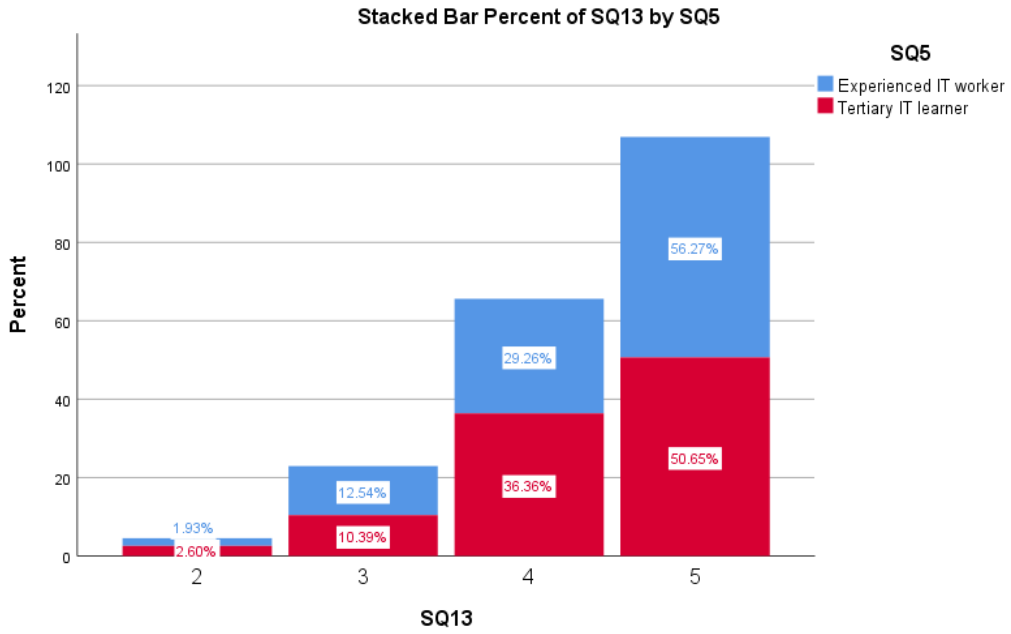

Figure 38 Stacked Bar Percent of SQ13 by SQ5_Occupation

Table 37 and Figure 35 reflects 55.2% of participants choose “Completely satisfied”, and 30.7% choose “Mostly satisfied”. For the rest, 12.1% prefer “Neutral” and 2.1% choose “Mostly dissatisfied”. Therefore, most IT professionals (85.9%) think it is easy to import data from data visualization tools.

Figure 36 represents that most people in all age groups choose “Completely satisfied”, with the most significant number of people aged 26-35, at 58.90%. The 50.00% of people over the age of 45 choose “Mostly satisfied”. Figure 37 reveals that most people, both male and female, opt for “Completely satisfied”, at 54.01% and 59.60%, respectively. However, more females than males choose “Mostly dissatisfied”. Figure 38 describes that more experienced IT workers feel “Completely satisfied” than tertiary IT learners.

SQ 14 How easy is it to transform the data in the data visualization tools that you use? (Related to data source connection)

Statistics		
SQ14		
N	Valid	388
	Missing	0

Table 38 Statistics of Participants to SQ14

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 Mostly dissatisfied	12	3.1	3.1	3.1
	3 Neutral	64	16.5	16.5	19.6
	4 Mostly satisfied	150	38.7	38.7	58.2
	5 Completely satisfied	162	41.8	41.8	100.0
	Total	388	100.0	100.0	

Table 39 Frequency of Participants Concern about it is Easy to Transform the Data into DVT

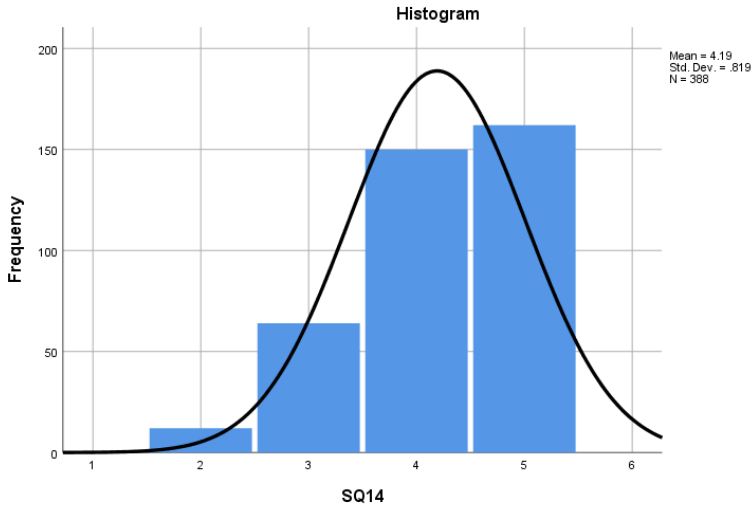

Figure 39 Histogram Chart Showing the Level of Participants Think about it is Easy to Transform the Data into DVT

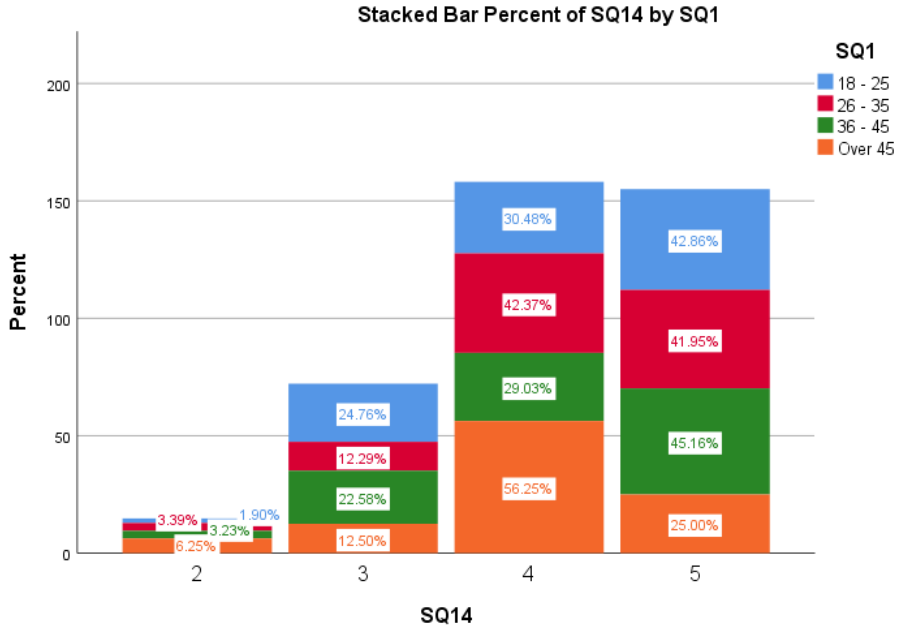

Figure 40 Stacked Bar Percent of SQ14 by SQ1_Age

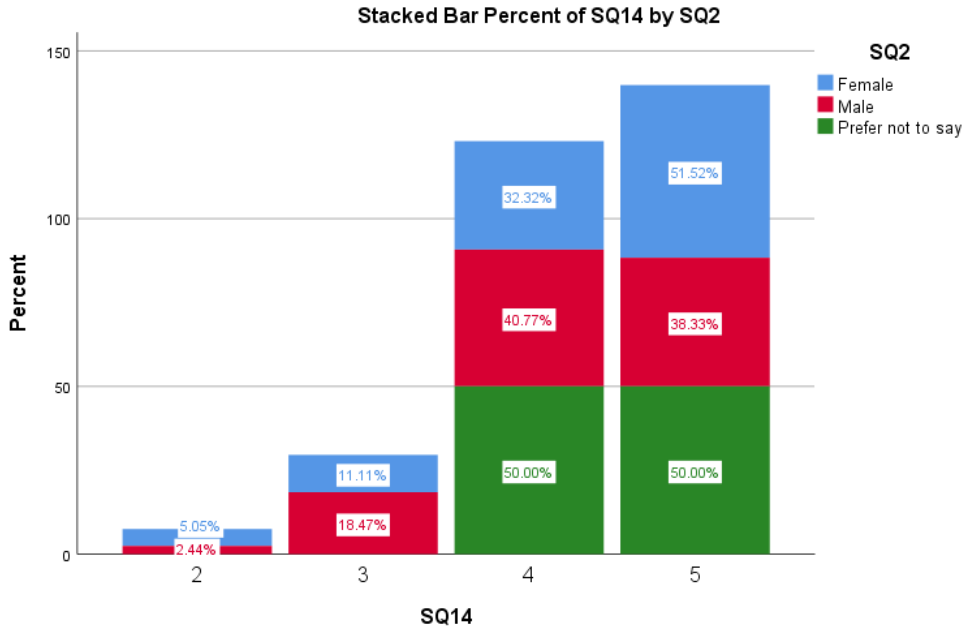

Figure 41 Stacked Bar Percent of SQ14 by SQ2_Gender

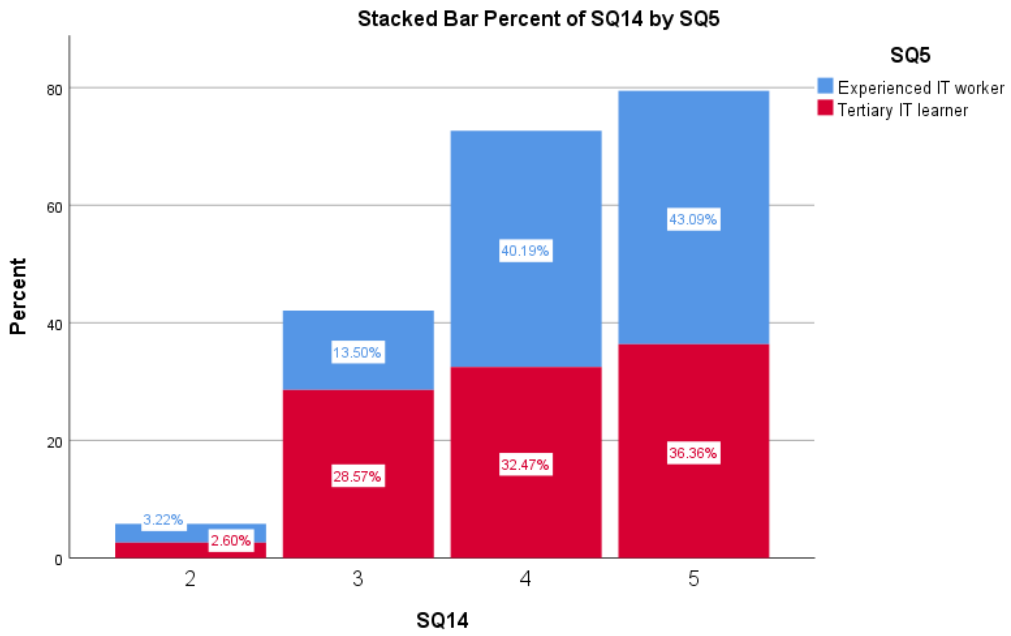

Figure 42 Stacked Bar Percent of SQ14 by SQ5_Occupation

As can be seen from Table 39 and Figure 39, 41.8% of participants choose "Completely satisfied", and a similar number of people (38.7%) choose "Mostly satisfied". Therefore, most IT professionals (80.5%) think it is easy to transform data into data visualization tools.

Figure 40 shows that most participants in the age group below 45 years choose "Completely satisfied", with a slightly higher proportion (45.16%) in the 36-45 age group. The majority choose "Mostly satisfied" for those aged 45 and over and those aged 26-35, at 56.25% and 42.37%, respectively. Figure 41 shows that most females (51.52%) choose "Completely satisfied", and only a small number (5.05%) choose "Mostly dissatisfied". The most significant number of males (40.77%) choose "Mostly satisfied". It is clear from Figure 42, the majority of those who prefer "Completely satisfied" and "Mostly satisfied" are experienced IT workers. The majority of those who choose "Neutral" is tertiary IT learners.

SQ 15 Is training on the data visualization tools that you use available and accessible to all users? (Related to help documentation)

Statistics		
SQ15		
N	Valid	388
	Missing	0

Table 40 Statistics of Participants to SQ15

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	80	20.6	20.6	20.6
	No	43	11.1	11.1	31.7
	Yes	265	68.3	68.3	100.0
	Total	388	100.0	100.0	

Table 41 Frequency of Participants Concern about Available and Accessible Training on DVT

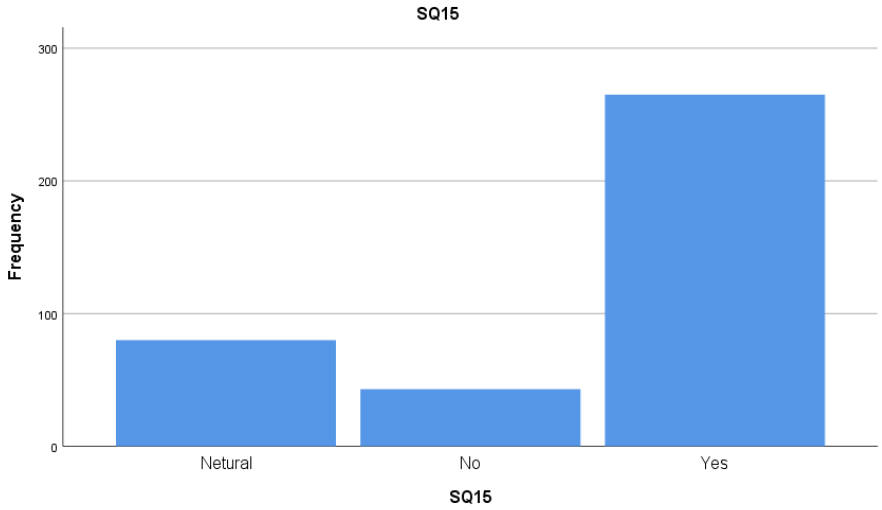

Figure 43 Bar Chart Showing the Level of Participants Think about Available and Accessible Training on DVT

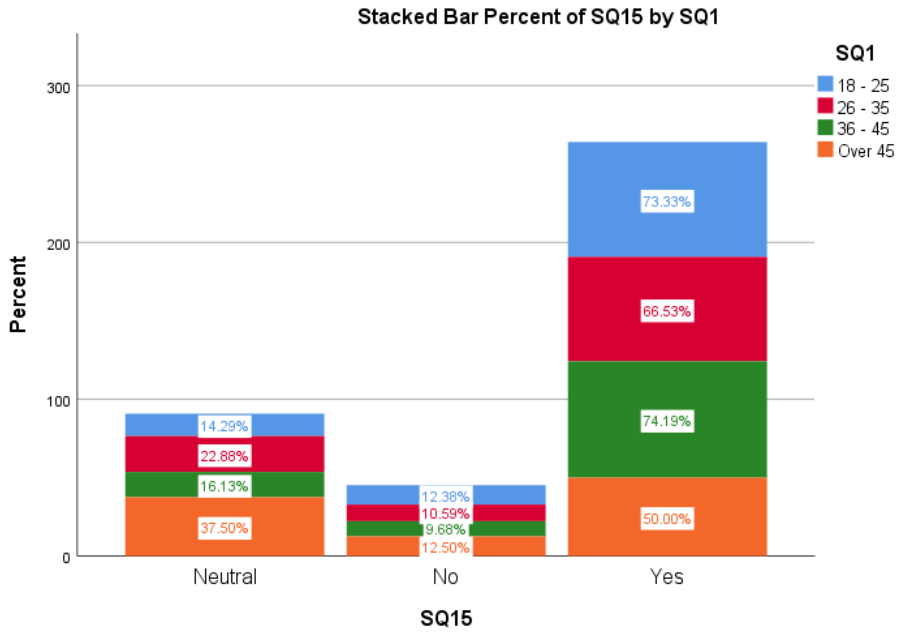

Figure 44 Stacked Bar Percent of SQ15 by SQ1_Age

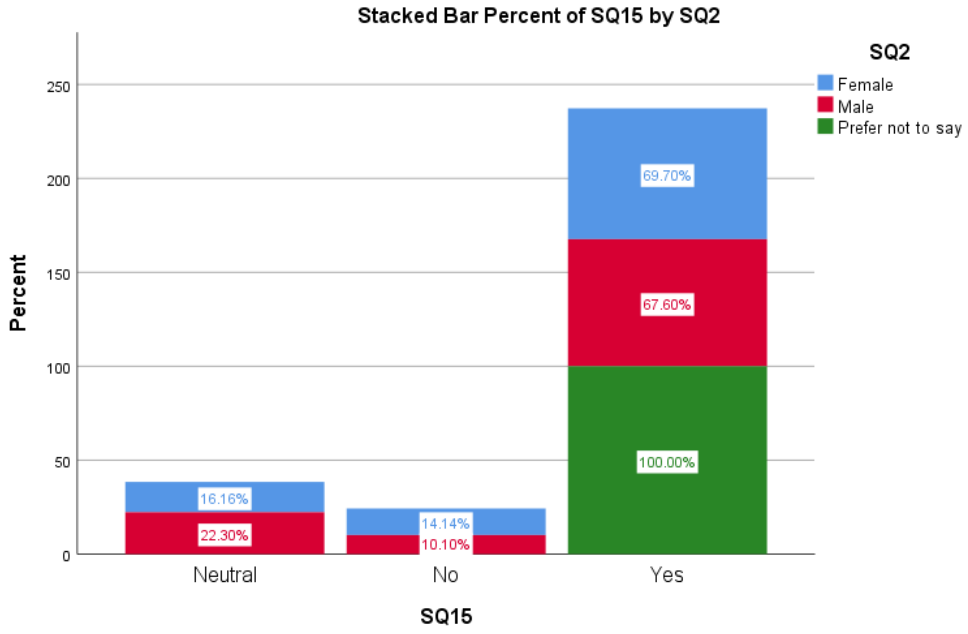

Figure 45 Stacked Bar Percent of SQ15 by SQ2_Gender

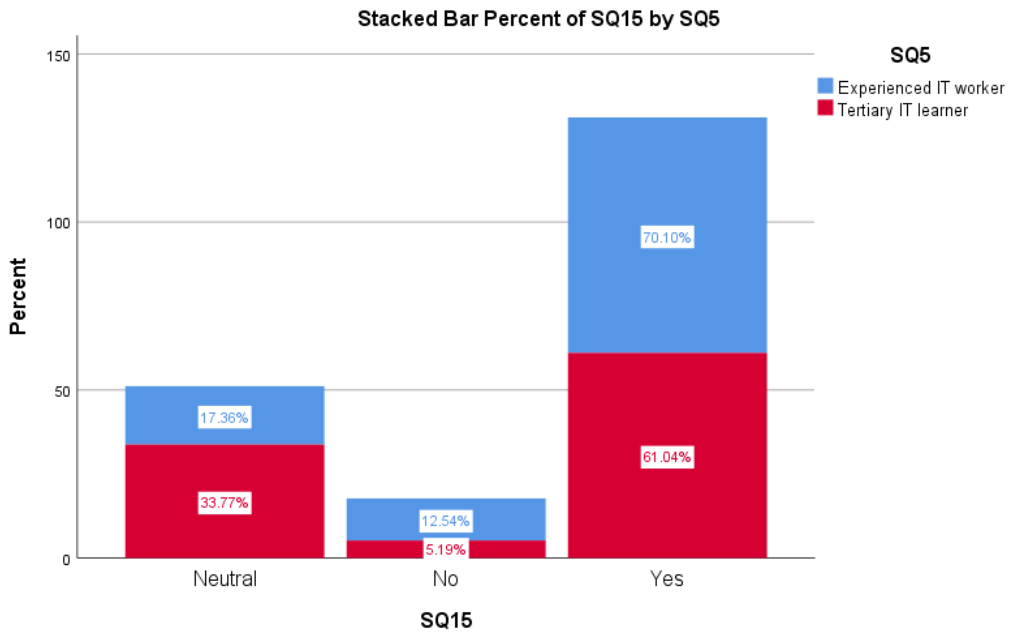

Figure 46 Stacked Bar Percent of SQ15 by SQ5_Occupation

From Table 41 and Figure 43, 68.3% of participants choose “Yes”. It can conclude that most of the data visualization tools used by IT professionals have an available and accessible training function. In Figure 44, most of the data visualization tools used by the age group 36-45 have a training function. Figure 45 indicates that both men and women, the tools they use also have accessible training. It can be obviously seen from Figure 46 that most of the data visualization tools used by experienced IT workers (70.10%) have training features that are slightly higher than the visualization tools used by tertiary IT learners.

SQ 16 Are there self-paced tutorials on the data visualization tools that you use that user can access? (Related to help documentation)

Statistics		
SQ16		
N	Valid	388
	Missing	0

Table 42 Statistics of Participants to SQ16

SQ16					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	51	13.1	13.1	13.1
	No	28	7.2	7.2	20.4
	Yes	309	79.6	79.6	100.0
	Total	388	100.0	100.0	

Table 43 Frequency of Participants Concern about Available and Accessible Self-paced Tutorials on DVT

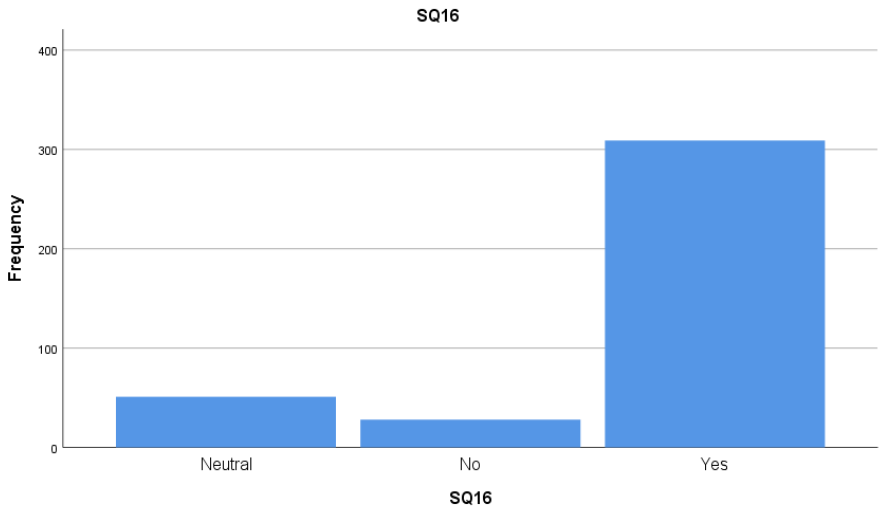

Figure 47 Bar Chart Showing the Level of Participants Think about Available and Accessible Self-paced Tutorials on DVT

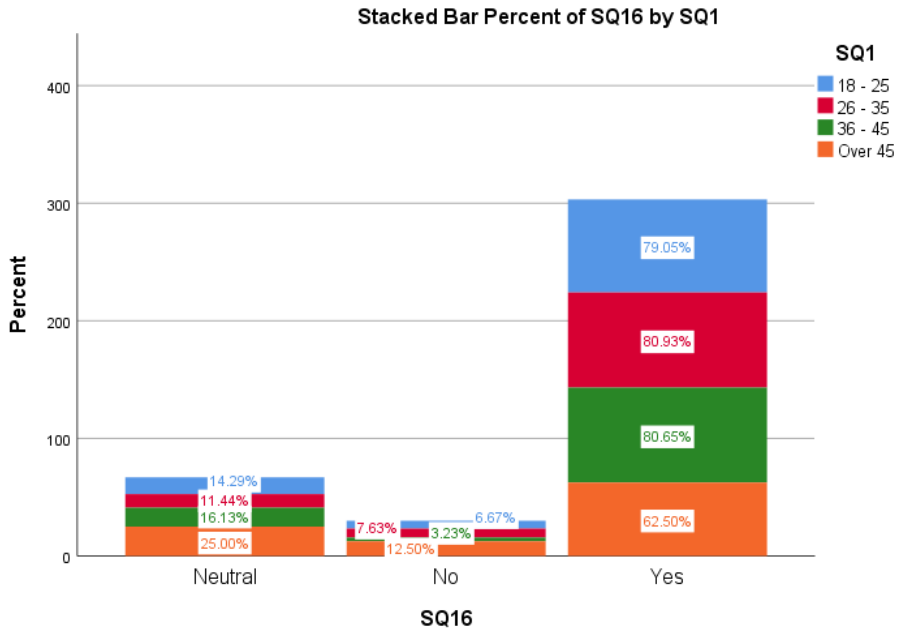

Figure 48 Stacked Bar Percent of SQ16 by SQ1_Age

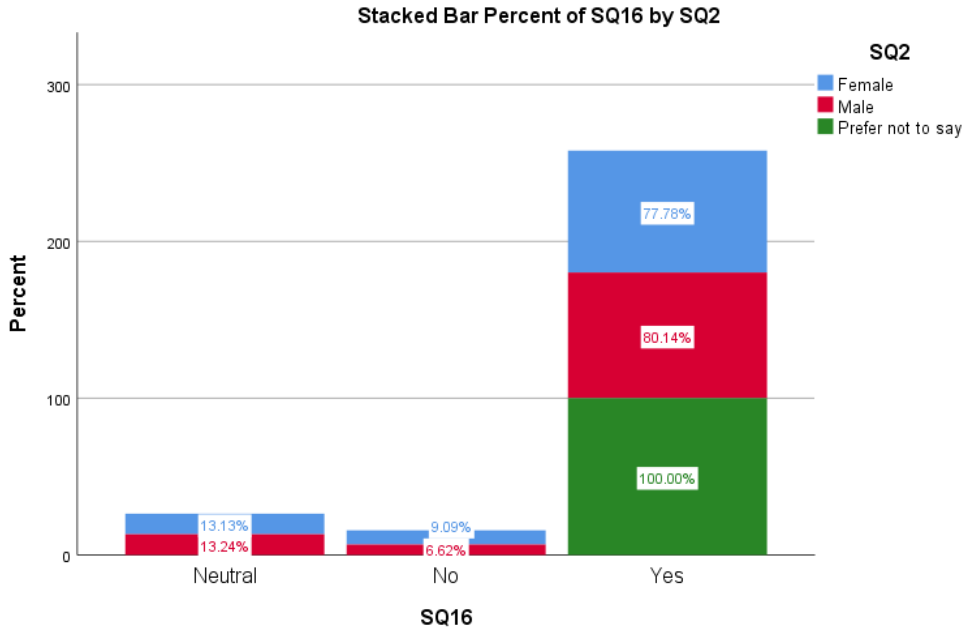

Figure 49 Stacked Bar Percent of SQ16 by SQ2_Gender

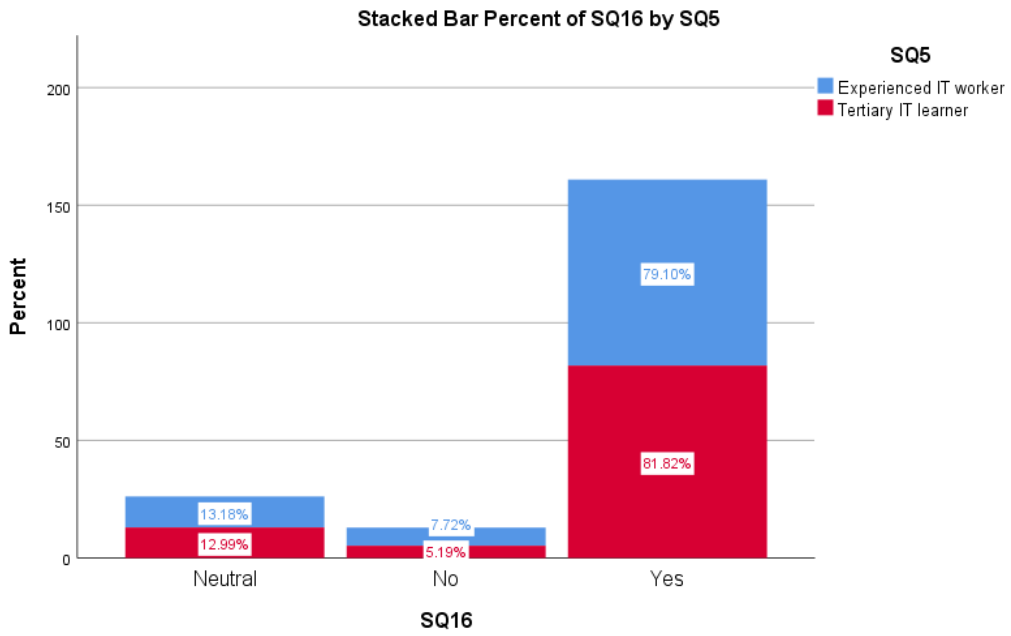

Figure 50 Stacked Bar Percent of SQ16 by SQ5_Occupation

Table 43 and Figure 47 clearly illustrate that 79.6% of participants choose “Yes”, which means most IT professionals have available and accessible self-paced tutorials on data visualization tools they used. According to Figure 48, most of the data visualization tools used by people across all age groups have an accessible self-paced tutorial. It can also be apparent in Figure 49 that the data visualization tools used by both males and females have an accessible self-paced tutorial. Figure 50 indicates that experienced IT workers choose “Yes” slightly less than tertiary IT learners.

SQ 17 Within the data visualization tools that you use, how easy is it for user to search and find answers to software-specific questions? (Related to help documentation)

Statistics		
SQ17		
N	Valid	388
	Missing	0

Table 44 Statistics of Participants to SQ17

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Completely dissatisfied	2	.5	.5	.5
	2 Mostly dissatisfied	16	4.1	4.1	4.6
	3 Neutral	93	24.0	24.0	28.6
	4 Mostly satisfied	172	44.3	44.3	72.9
	5 Completely satisfied	105	27.1	27.1	100.0
	Total	388	100.0	100.0	

Table 45 Frequency of Participants Concern about it is Easy to Search and Find Answers to Software-specific Questions within DVT

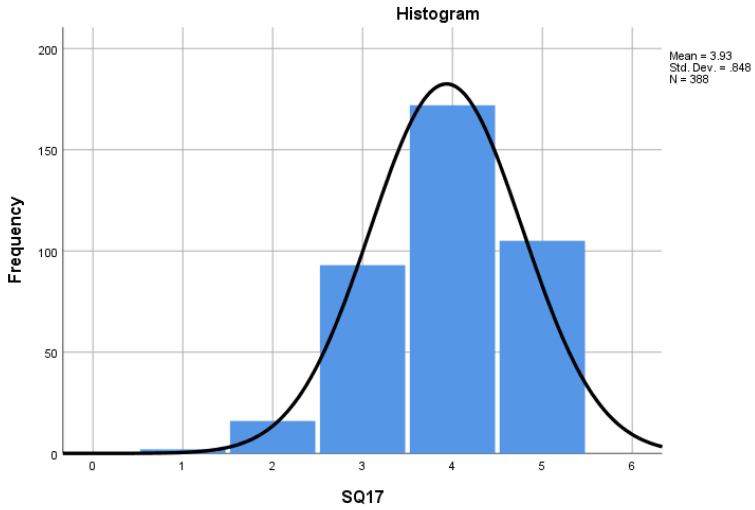

Figure 51 Histogram Chart Showing the Level of Participants Think about it is Easy to Search and Find Answers to Software-specific Questions within DVT

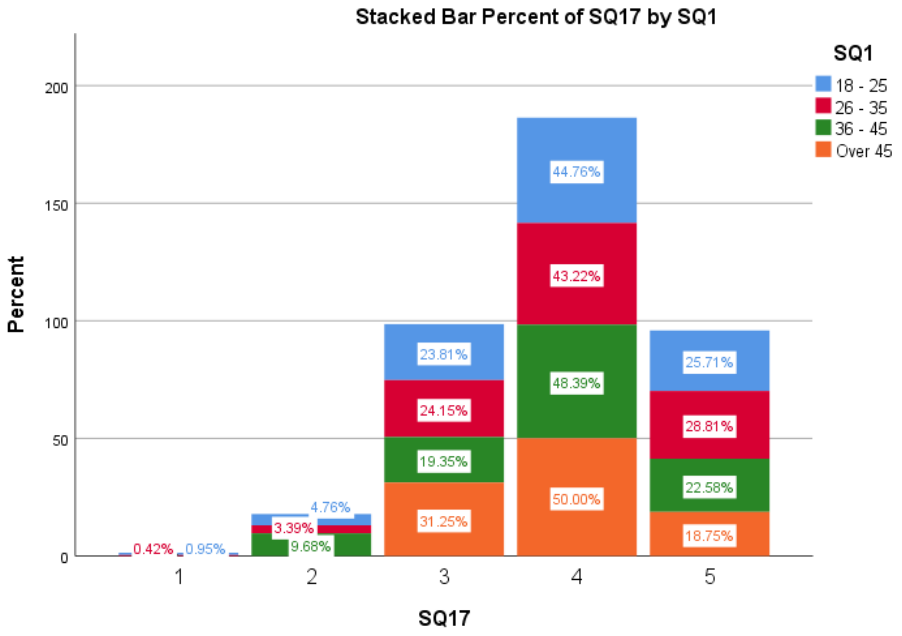

Figure 52 Stacked Bar Percent of SQ17 by SQ1_Age

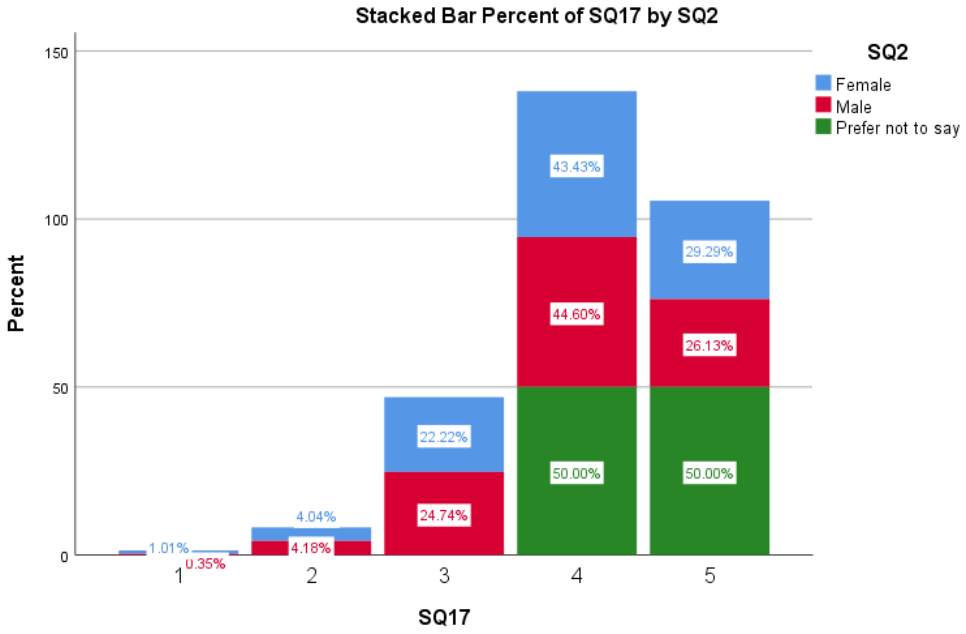

Figure 53 Stacked Bar Percent of SQ17 by SQ2_Gender

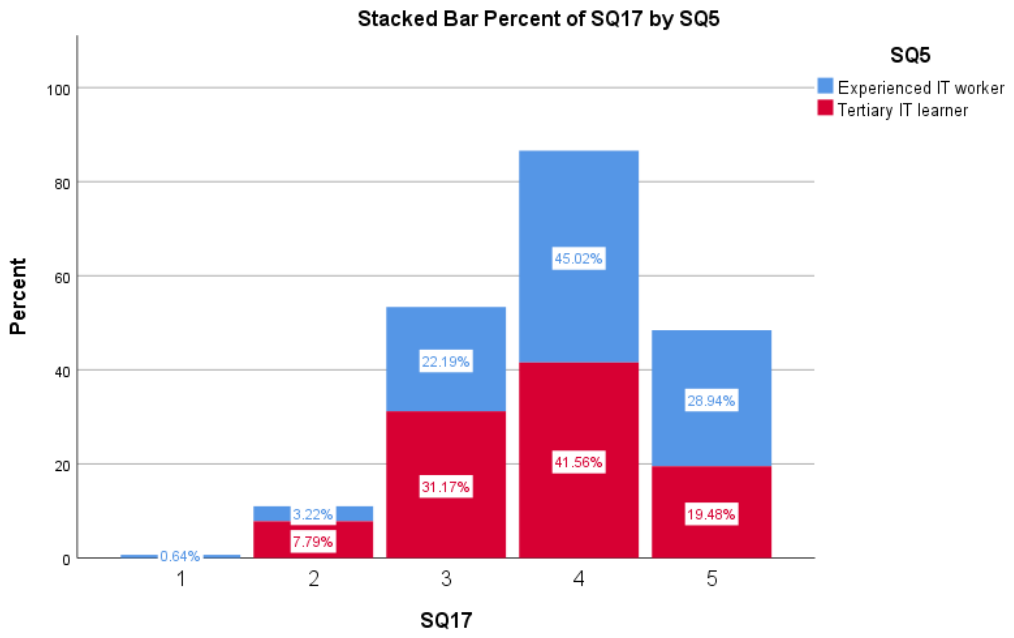

Figure 54 Stacked Bar Percent of SQ17 by SQ5_Occupation

It can be seen from Table 45 and Figure 51 that those who choose “Mostly satisfied” are significantly more likely to choose “Completely satisfied”, at 44.3% and 27.1%, respectively. Hence, the data lead to the conclusion that most IT professionals (71.4%) think it is easy to search and find answers to software specific questions within the data visualization tools they used.

Figure 52 shows that regardless of age group, the majority of people choose “Mostly satisfied”. According to Figure 53, most people, both men and women, choose “Mostly satisfied”, and the proportion of men and women is the same, at 44.60% and 43.43%, respectively. In Figure 54, most experienced IT workers (45.02%) choose “Mostly satisfied”, and only a few IT workers (0.64%) choose “Completely dissatisfied”. The most significant number of tertiary IT learners (41.56%) choose “Mostly satisfied”.

SQ 18 Is there a robust and active user community accessible to share and learn best practices, tips, etc.? (Related to help documentation)

Statistics		
SQ18		
N	Valid	388
	Missing	0

Table 46 Statistics of Participants to SQ18

SQ18					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	60	15.5	15.5	15.5
	No	30	7.7	7.7	23.2
	Yes	298	76.8	76.8	100.0
	Total	388	100.0	100.0	

Table 47 Frequency of Participants Concern about Accessible User Community within the DVT

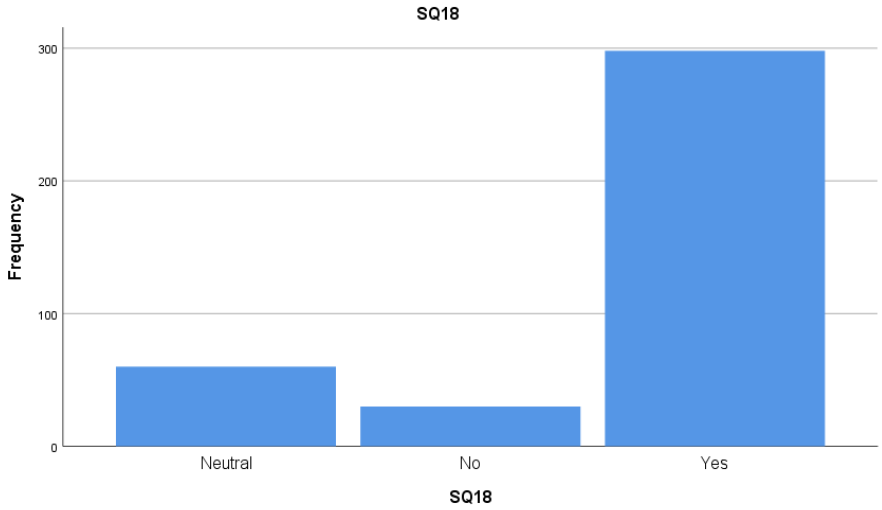

Figure 55 Bar Chart Showing the Level of Participants Think about Accessible User Community within the DVT

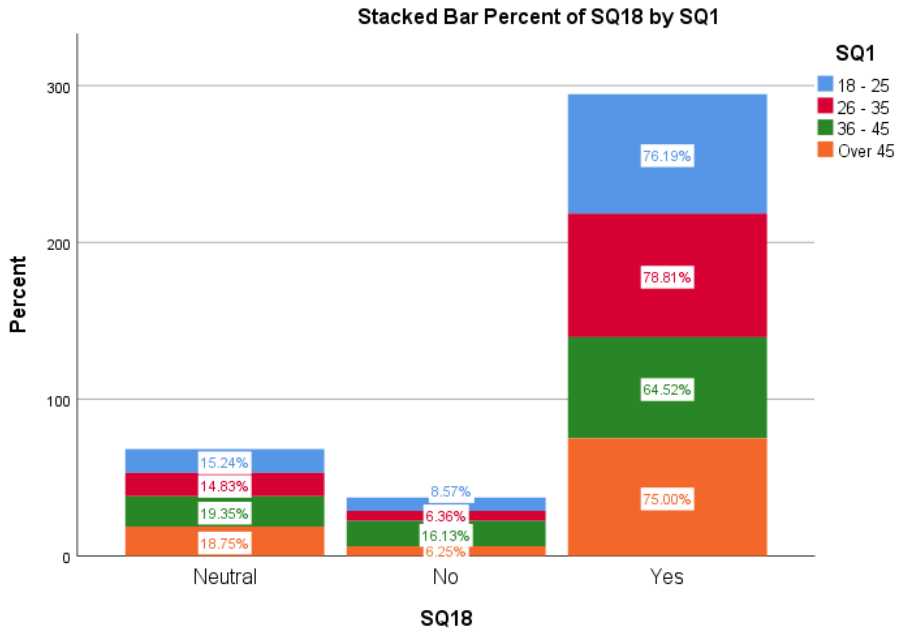

Figure 56 Stacked Bar Percent of SQ18 by SQ1_Age

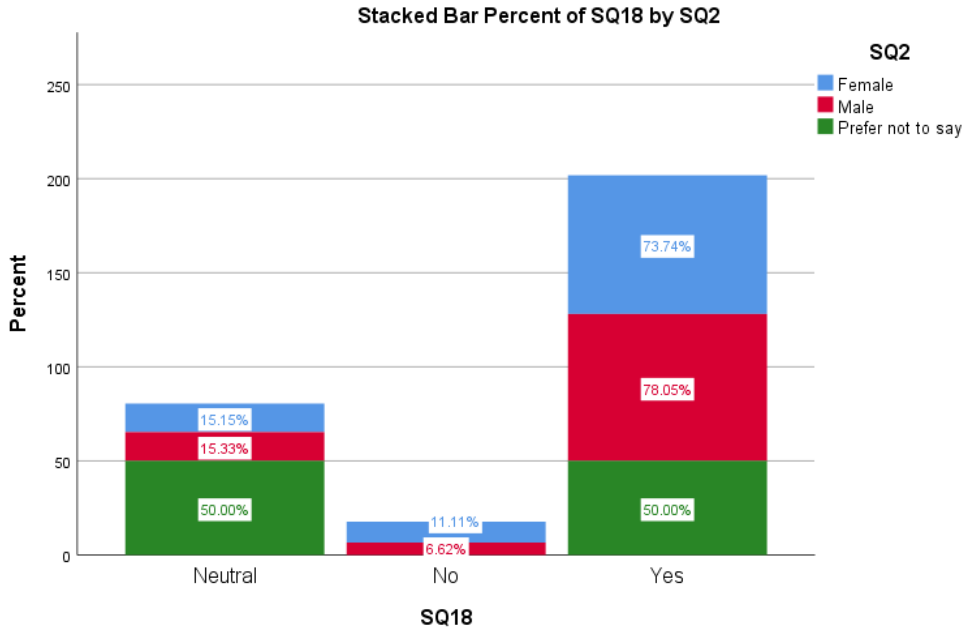

Figure 57 Stacked Bar Percent of SQ18 by SQ2_Gender

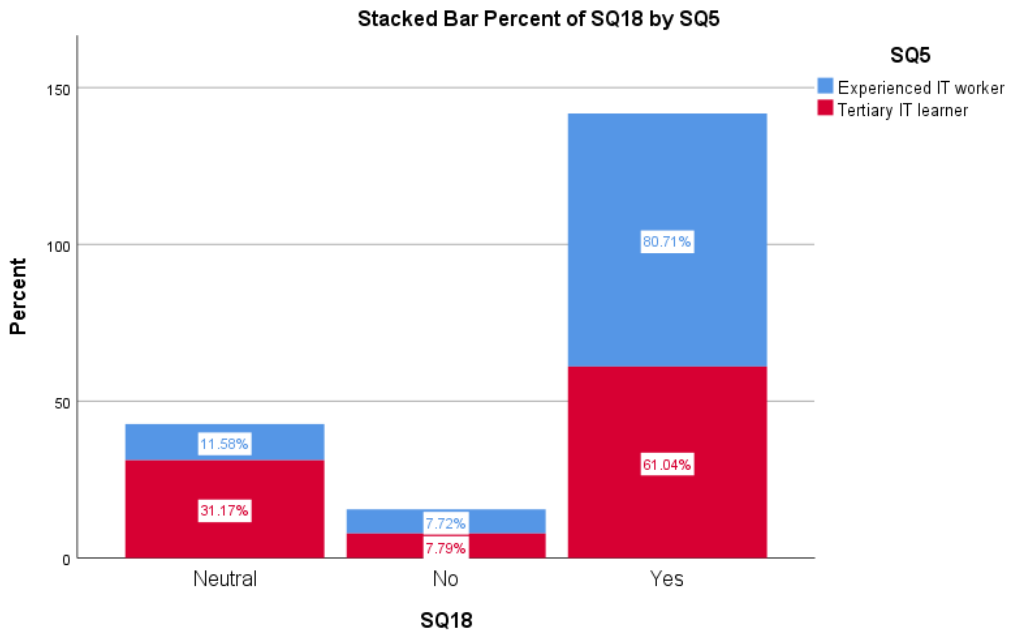

Figure 58 Stacked Bar Percent of SQ18 by SQ5_Occupation

According to Table 47 and Figure 55, 76.8% of participant choose “Yes”, which means most IT professionals have an accessible user community within the data visualization tools they used. Figure 56 reveals that most people across all age groups choose “Yes”, and they are in a similar percentage. It can see from Figure 57 that more males choose “Yes” at 78.05%, which is slightly higher than female (73.74%). In Figure 58, 80.71% of experienced IT workers choose “Yes”, which is significantly more than tertiary IT learners (61.04%).

SQ 19 Does it have free version/free trial? (Related to pricing package)

Statistics		
SQ19		
N	Valid	388
	Missing	0

Table 48 Statistics of Participants to SQ19

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	41	10.6	10.6	10.6
	No	27	7.0	7.0	17.5
	Yes	320	82.5	82.5	100.0
	Total	388	100.0	100.0	

Table 49 Frequency of Participants Concern about Free Version/Free Trial

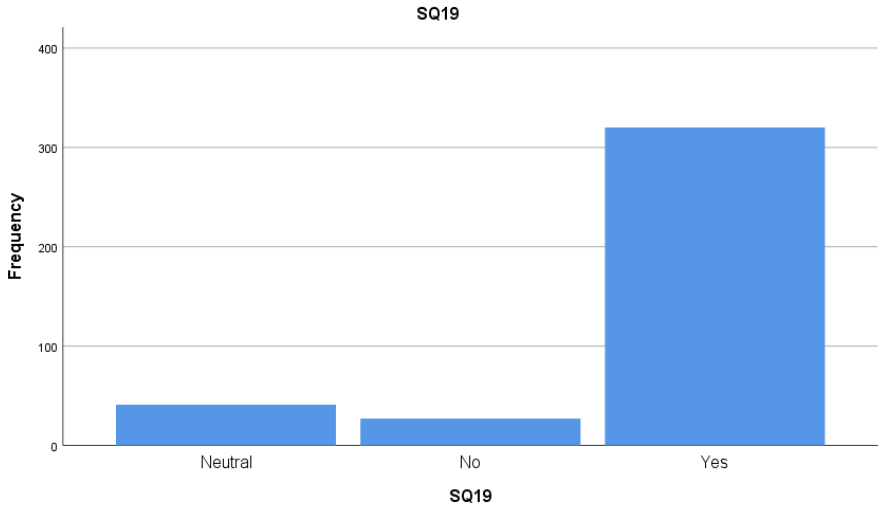

Figure 59 Bar Chart Showing the Level of Participants Think about Free Version/Free Trial

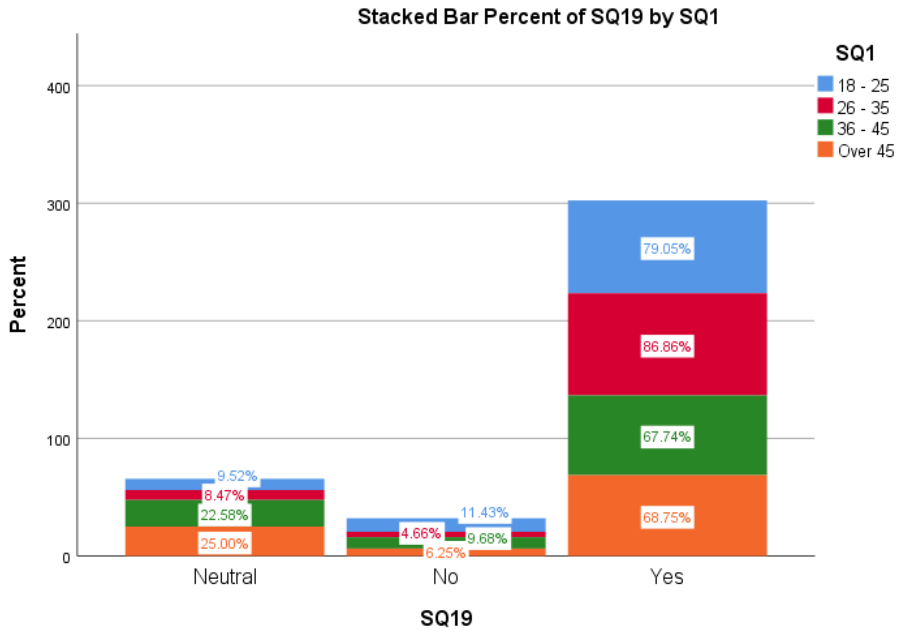

Figure 60 Stacked Bar Percent of SQ19 by SQ1_Age

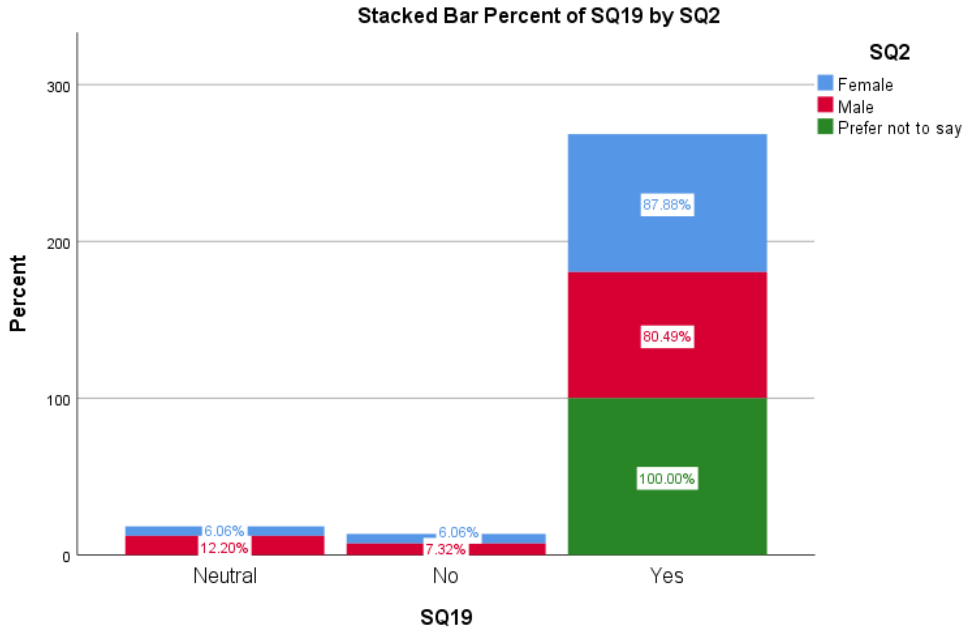

Figure 61 Stacked Bar Percent of SQ19 by SQ2_Gender

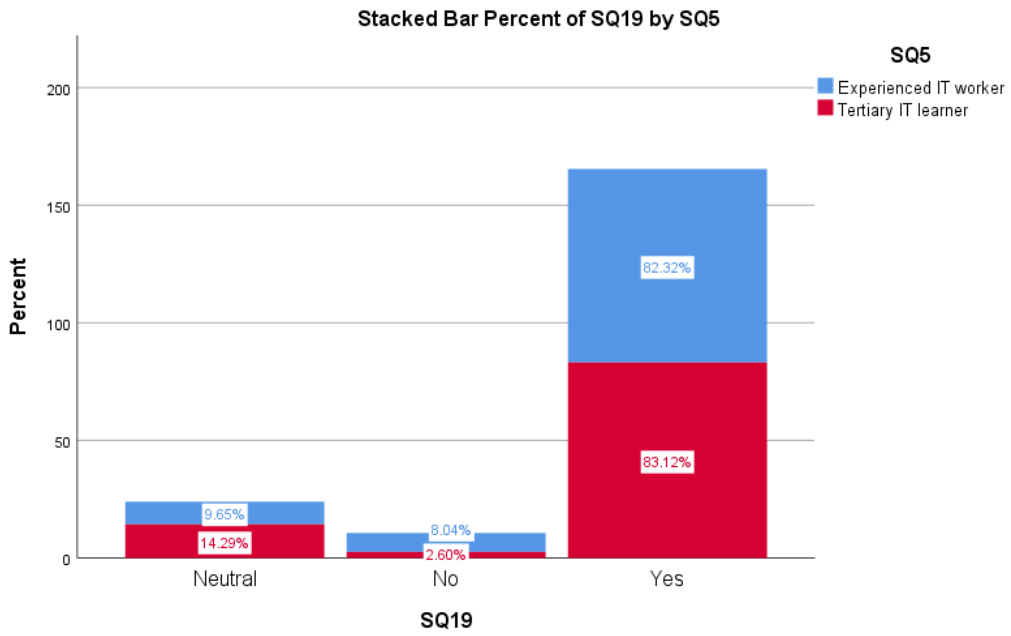

Figure 62 Stacked Bar Percent of SQ19 by SQ5_Occupation

In Table 49 and Figure 59, 82.5% choose “Yes”, which means most data visualization tools used by IT professionals have a free version. Figure 60 shows that 86.86% of participants at the age 26-35 choose “Yes” significantly higher than other age groups. Figure 61 represents that most males and females choose “Yes”, at 80.49% and 87.88%, respectively. According to Figure 62, experience IT workers choose “Yes” is slightly less than tertiary IT learners. Conversely, experienced IT workers who choose “No” is more than tertiary IT learners.

SQ 20 Are the available licensing options clear and transparent? (Related to pricing package)

Statistics		
SQ20		
N	Valid	388
	Missing	0

Table 50 Statistics of Participants to SQ20

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	65	16.8	16.8	16.8
	No	17	4.4	4.4	21.1
	Yes	306	78.9	78.9	100.0
	Total	388	100.0	100.0	

Table 51 Frequency of Participants Concern about Available Licensing Options Clear and Transparent

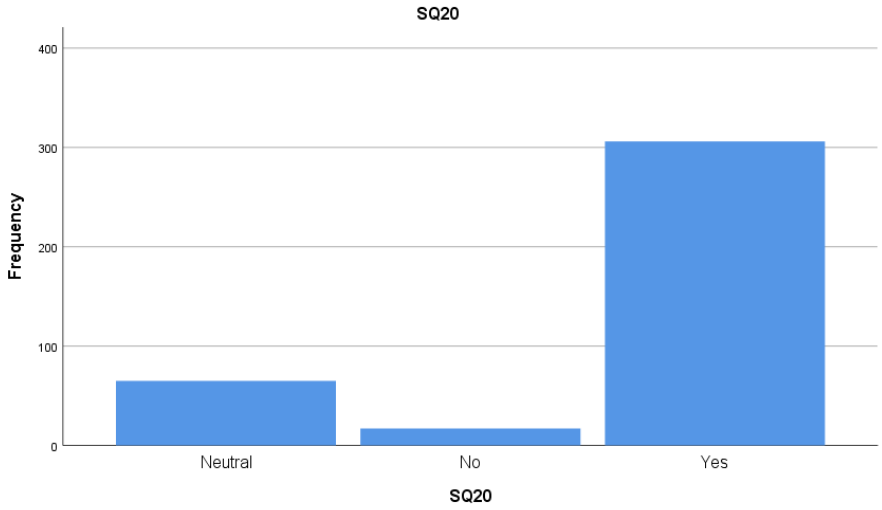

Figure 63 Bar Chart Showing the Level of Participants Think about Available Licensing Options Clear and Transparent

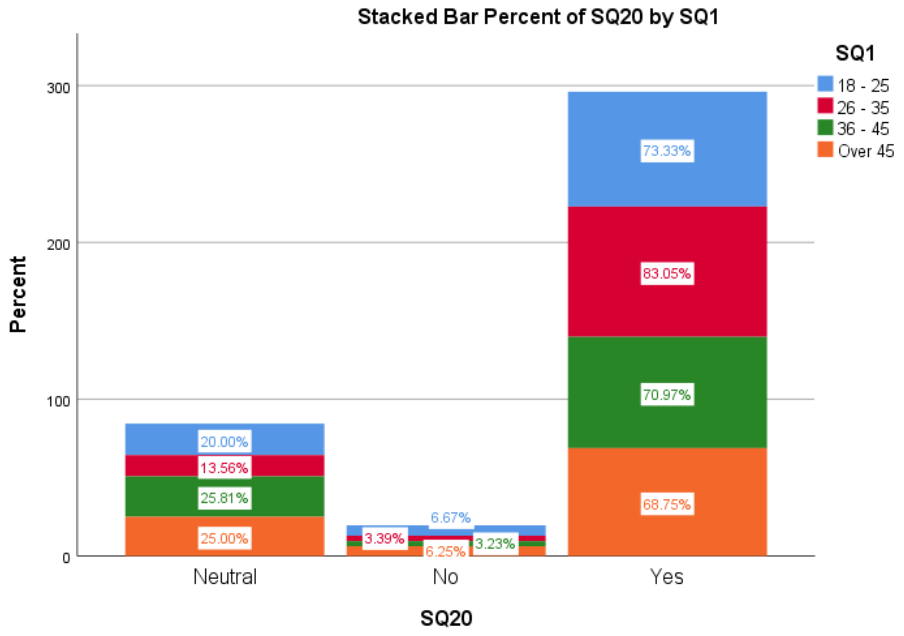

Figure 64 Stacked Bar Percent of SQ20 by SQ1_Age

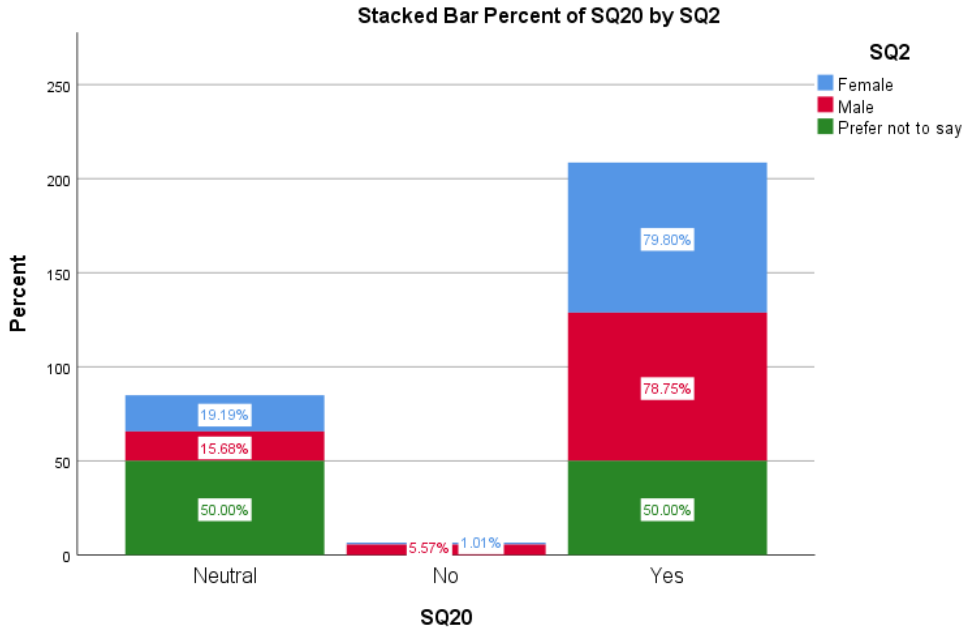

Figure 65 Stacked Bar Percent of SQ20 by SQ2_Gender

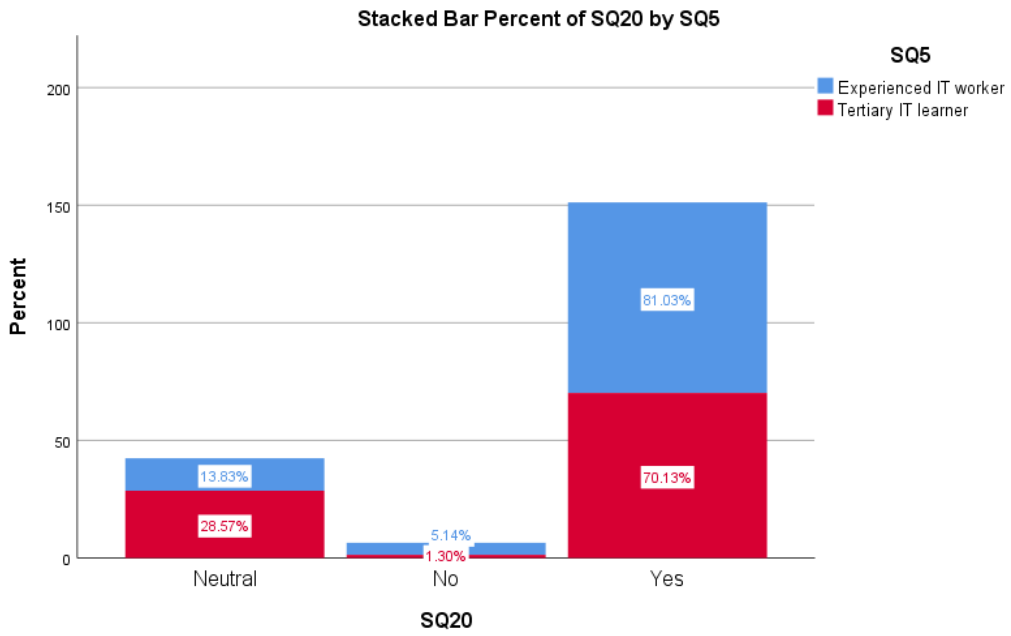

Figure 66 Stacked Bar Percent of SQ20 by SQ5_Occupation

It is represented in Table 51 and Figure 63 that 78.9% of participants choose “Yes”, which means most data visualization tools used by IT professionals have a clear and transparent licensing. Figure 64 reflects the people at the age 26-35 who choose “Yes”, and it is slightly higher than other age groups. According to Figure 65, most males and females choose “Yes”, but there is still a small proportion of males choose “No”, and more than females. Figure 66 indicates that 81.03% of experienced IT workers choose “Yes”, which is more than tertiary IT learners (70.13%).

SQ 21 Is the pricing model for the software easy to understand? (Related to pricing package)

Statistics		
SQ21		
N	Valid	388
	Missing	0

Table 52 Statistics of Participants to SQ21

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	84	21.6	21.6	21.6
	No	28	7.2	7.2	28.9
	Yes	276	71.1	71.1	100.0
	Total	388	100.0	100.0	

Table 53 Frequency of Participants Concern about it is Easy to Understand the Price Model of DVT

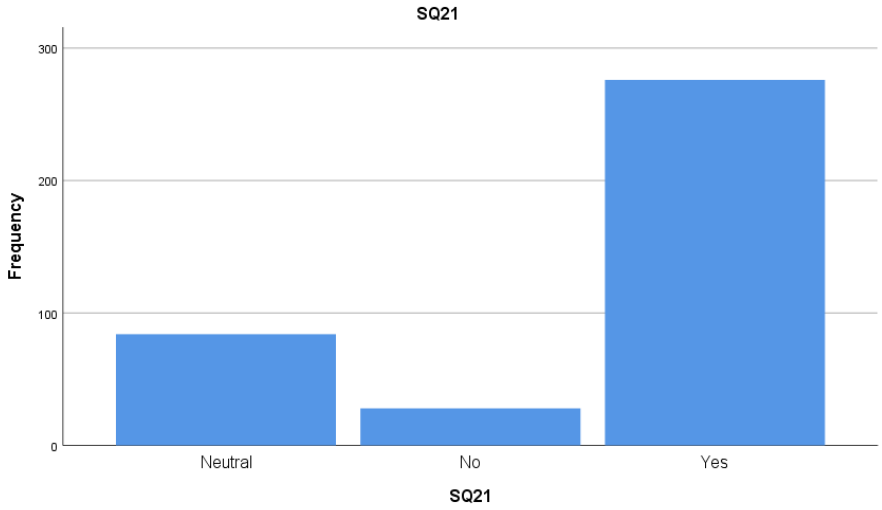

Figure 67 Bar Chart Showing the Level of Participants Think about it is Easy to Understand the Price Model of DVT

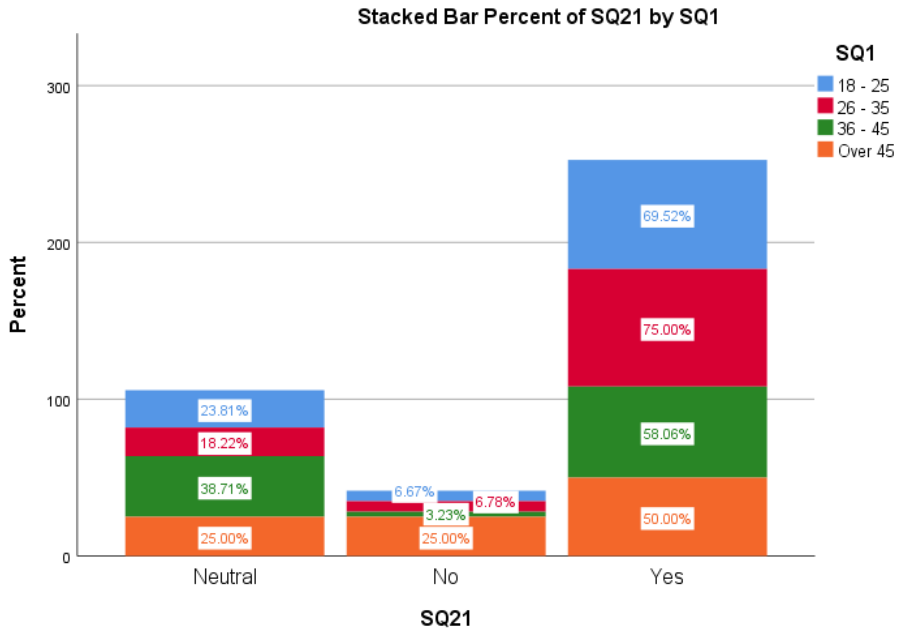

Figure 68 Stacked Bar Percent of SQ21 by SQ1_Age

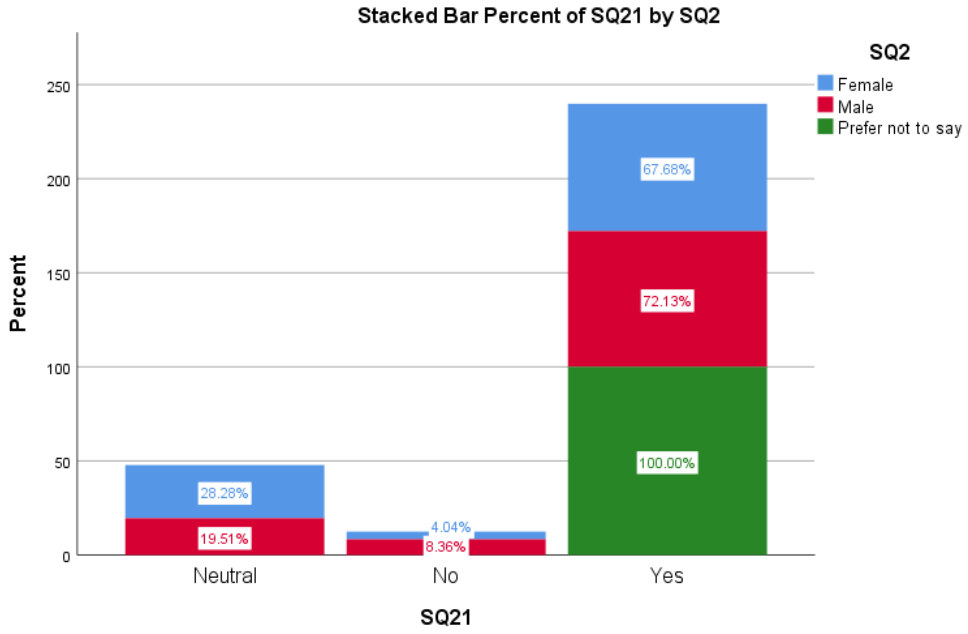

Figure 69 Stacked Bar Percent of SQ21 by SQ2_Gender

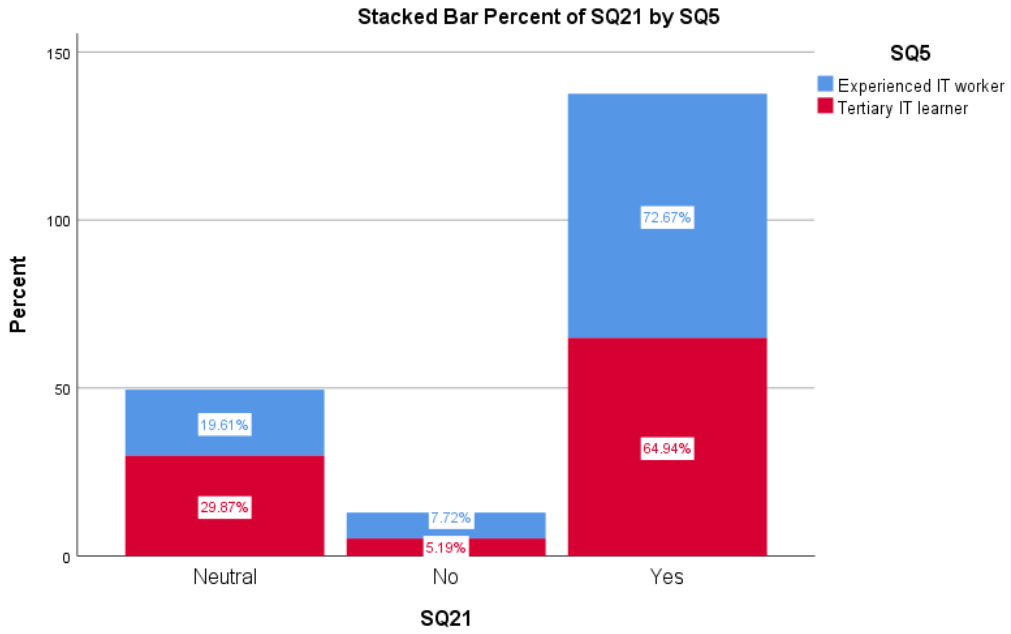

Figure 70 Stacked Bar Percent of SQ21 by SQ5_Occupation

As reflected from Table 53 and Figure 67, 71.1% of participants choose “Yes”, which means that most IT professionals think that it is easy to understand the price model of data visualization tools they used. Figure 68 describes a large number of participants at the age 26-35 (75.00%) choose “Yes”. It can be seen from Figure 69 that the majority of males (72.13%) choose “Yes”, which is slightly higher than females (67.68%) choose “Yes”. According to Figure 70, the most experienced IT workers choose “Yes”, at 72.67%.

SQ 22 Is the pricing model for the software flexible and scalable? (Related to pricing package)

Statistics		
SQ22		
N	Valid	388
	Missing	0

Table 54 Statistics of Participants to SQ22

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	109	28.1	28.1	28.1
	No	33	8.5	8.5	36.6
	Yes	246	63.4	63.4	100.0
	Total	388	100.0	100.0	

Table 55 Frequency of Participants Concern about Flexible and Scalable Price Model of DVT

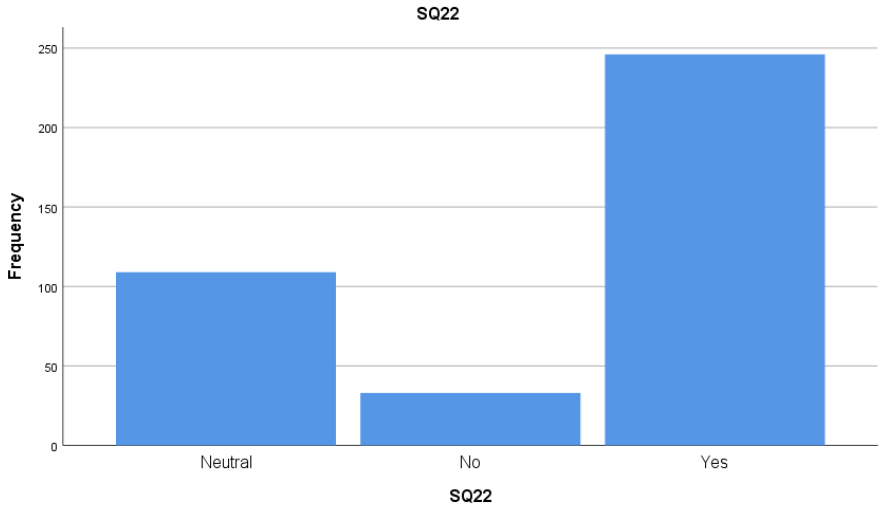

Figure 71 Bar Chart Showing the Level of Participants Think about Flexible and Scalable Price Model of DVT

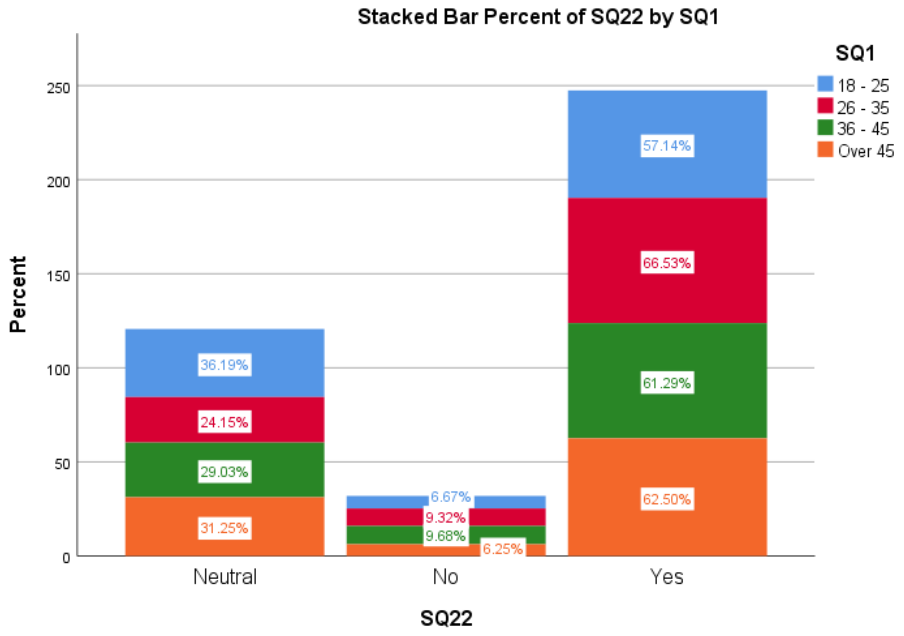

Figure 72 Stacked Bar Percent of SQ22 by SQ1_Age

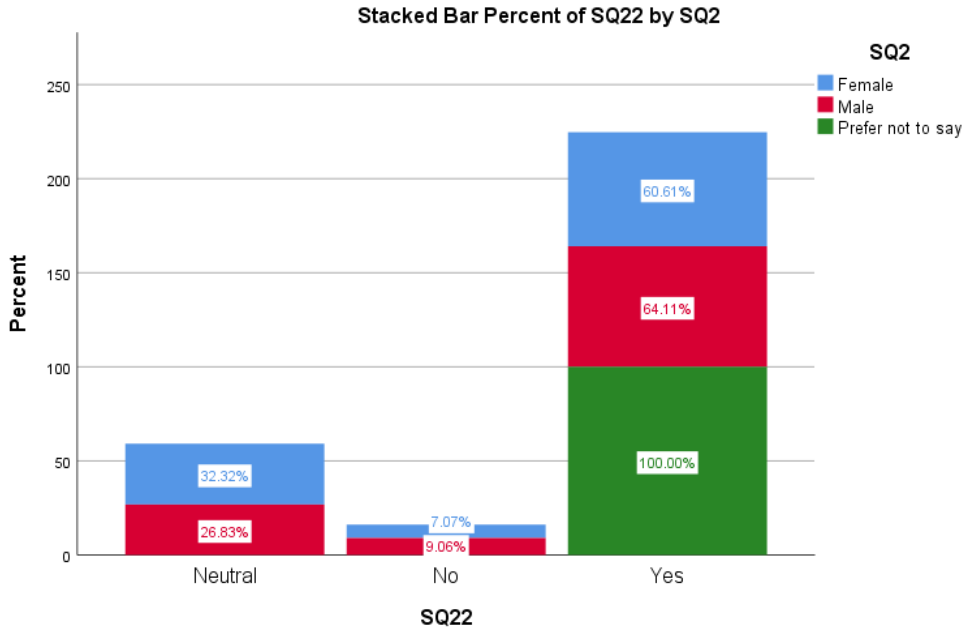

Figure 73 Stacked Bar Percent of SQ22 by SQ2_Gender

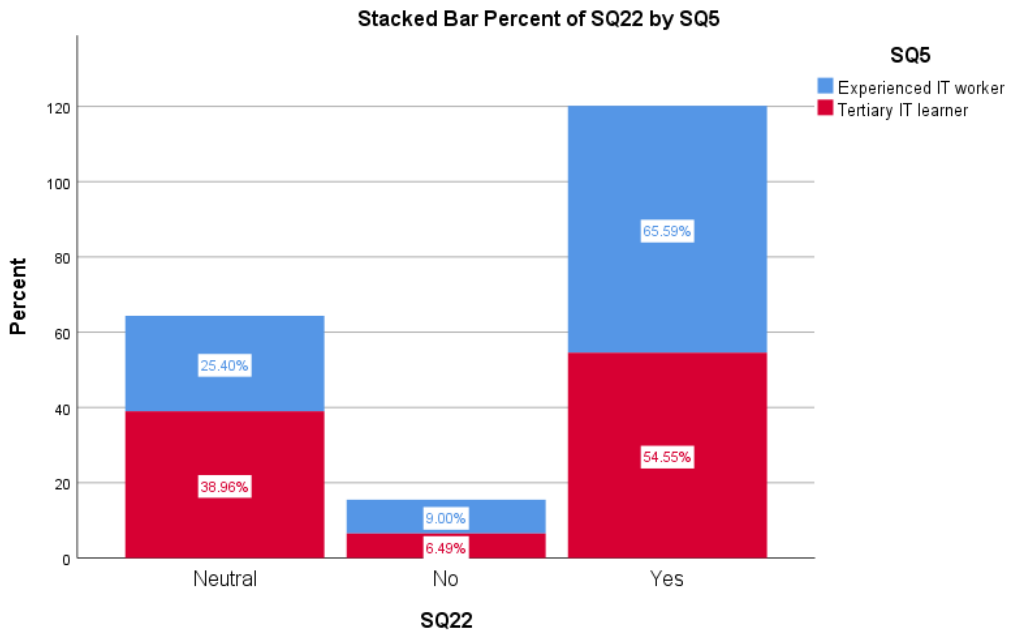

Figure 74 Stacked Bar Percent of SQ22 by SQ5_Occupation

According to Table 55 and Figure 71, 63.4% of participants choose “Yes”, which means most IT professionals think it has a flexible and scalable price mode of data visualization tools they used. According to Figure 72, there is still the age group between 26-35 who choose “Yes” the most. Figure 73 indicates that 64.11% of males and 60.61% of females choose “Yes”, and Figure 74 reveals that 66.56% of experienced IT workers choose “Yes”, which is higher than tertiary IT learners (54.55%).

SQ 23 How often does it update the functionalities? (Related to updates of functionality)

Statistics		
SQ23		
N	Valid	388
	Missing	0

Table 56 Statistics of Participants to SQ23

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Every six months	26	6.7	6.7	6.7
	Every three months	74	19.1	19.1	25.8
	Never	3	.8	.8	26.5
	Not focus on it	118	30.4	30.4	57.0
	Once a month	145	37.4	37.4	94.3
	Once a year	22	5.7	5.7	100.0
	Total	388	100.0	100.0	

Table 57 Frequency of Participants Concern about Frequency of Functionality Updates

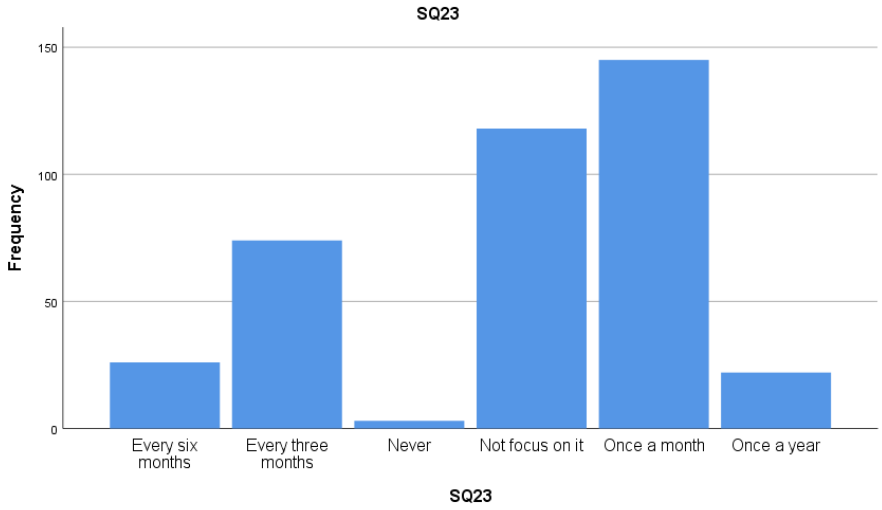

Figure 75 Bar Chart Showing the Level of Participants Think about Frequency of Functionality Updates

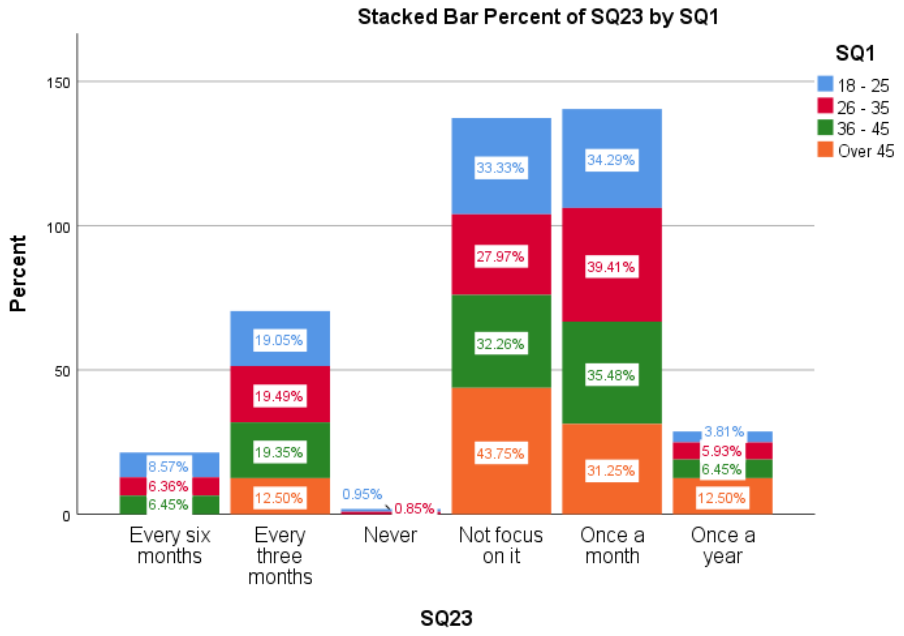

Figure 76 Stacked Bar Percent of SQ23 by SQ1_Age

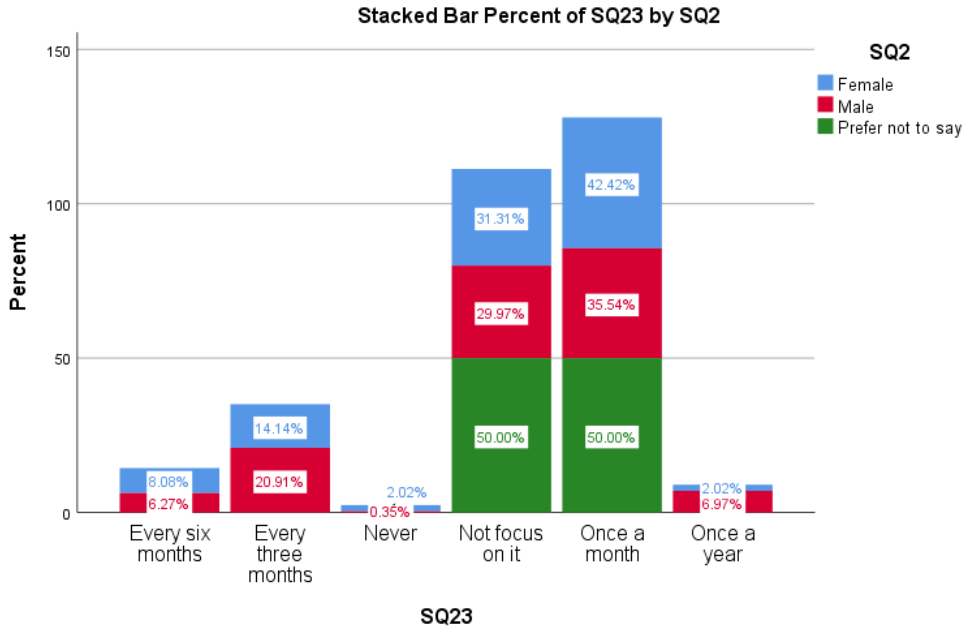

Figure 77 Stacked Bar Percent of SQ23 by SQ2_Gender

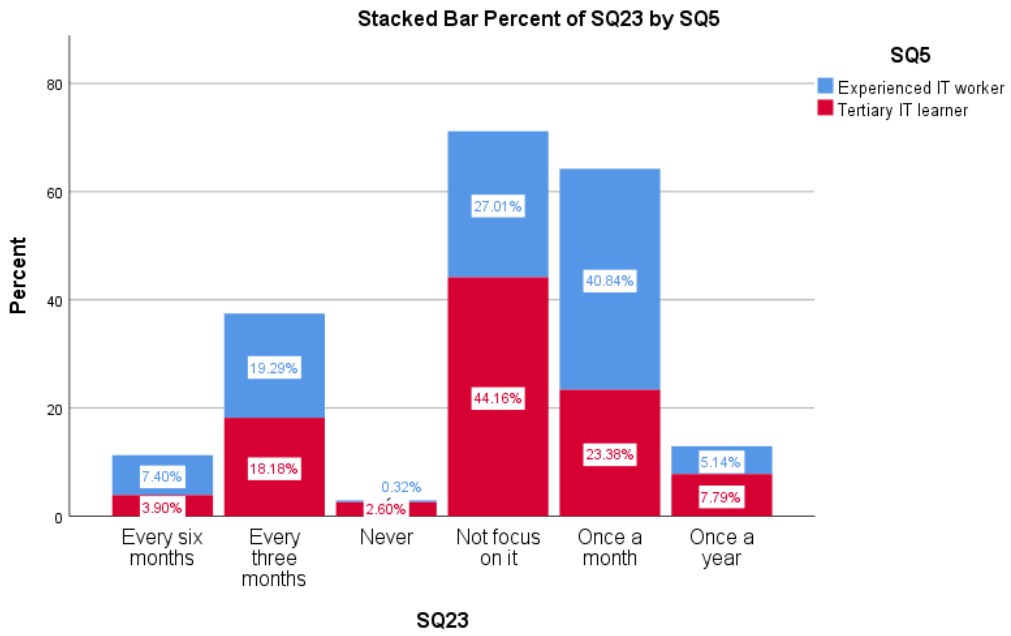

Figure 78 Stacked Bar Percent of SQ23 by SQ5_Occupation

It can be known from Table 57 and Figure 75 that 37.4% of data visualization tools used by participants is updated “Once a month”, then 30.4% of participants choose “Not focus on it”. Next, 19.1% of participants choose “Every three months”. These three options are the most heavily weighted. According to Figure 76, the option “Once a month” is the most selected by those in the age group 26-35, at 39.41%. Most people at the age of over 45 choose “Not focus on it”. There is a similar number of people in all age groups who choose “Every three months”. Figure 77 indicates that most female choose “Not focus on it” and “Once a month”. Figure 78 shows that the most experienced IT workers choose “Every three months” and “Once a month” most frequently, at 19.29% and 40.84%, respectively. Most IT leaners choose “Not focus on it”.

SQ 24 How easy is it to use updated functionalities? (Related to update of functionality)

Statistics		
SQ24		
N	Valid	388
	Missing	0

Table 58 Statistics of Participants to SQ24

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 Mostly dissatisfied	6	1.5	1.5	1.5
	3 Neutral	77	19.8	19.8	21.4
	4 Mostly satisfied	164	42.3	42.3	63.7
	5 Completely satisfied	141	36.3	36.3	100.0
	Total	388	100.0	100.0	

Table 59 Frequency of Participants Concern about it is Easy to Use Updated Functions

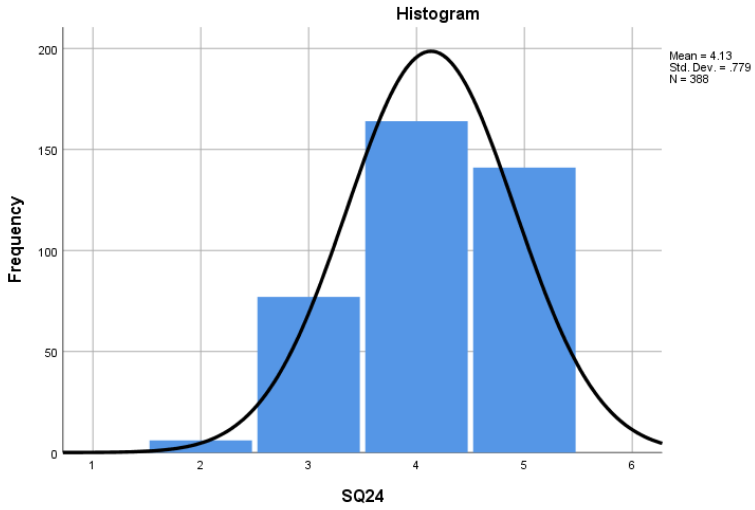

Figure 79 Histogram Chart Showing the Level of Participants Think about it is Easy to Use Updated Functions

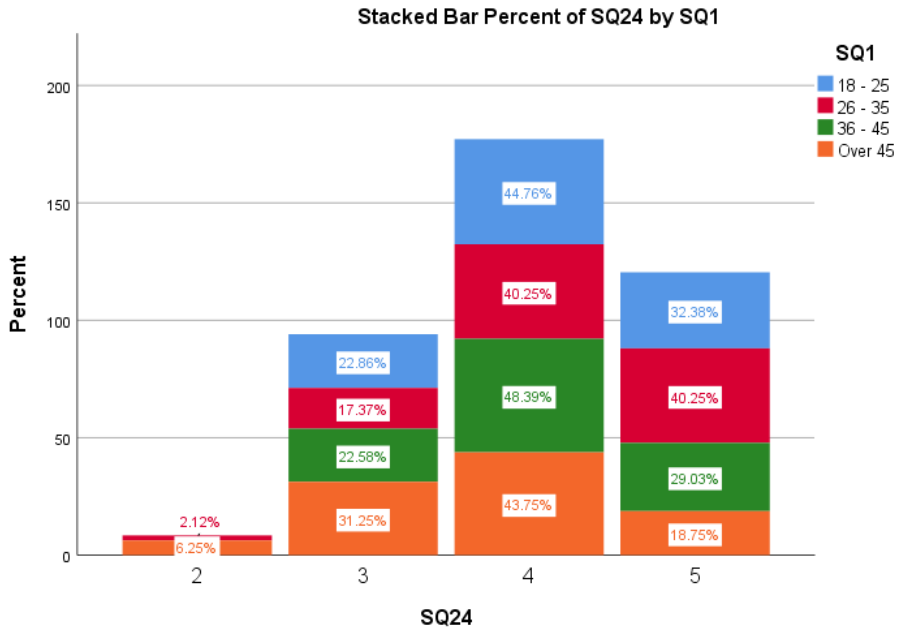

Figure 80 Stacked Bar Percent of SQ24 by SQ1_Age

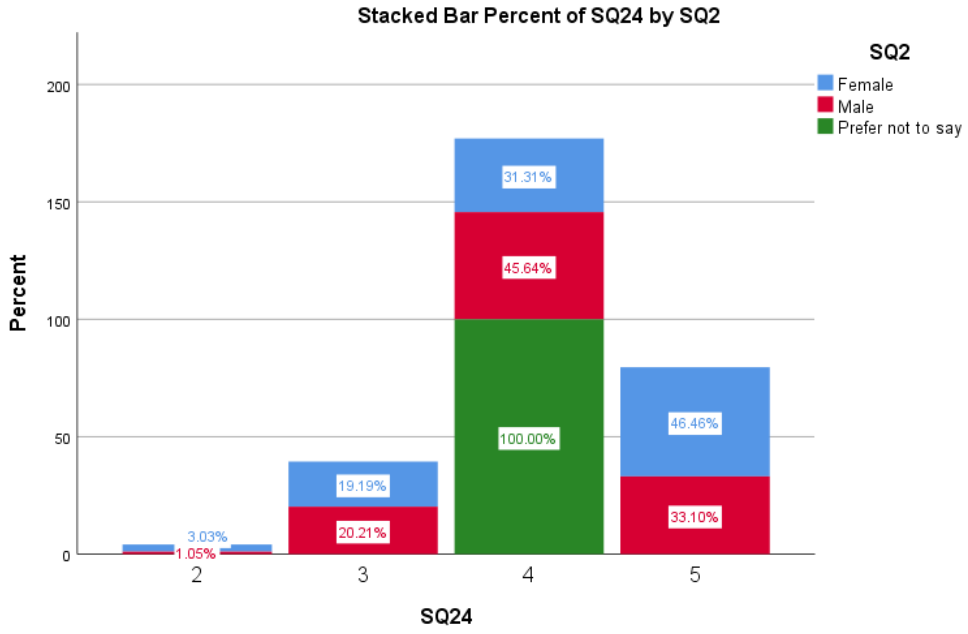

Figure 81 Stacked Bar Percent of SQ24 by SQ2_Gender

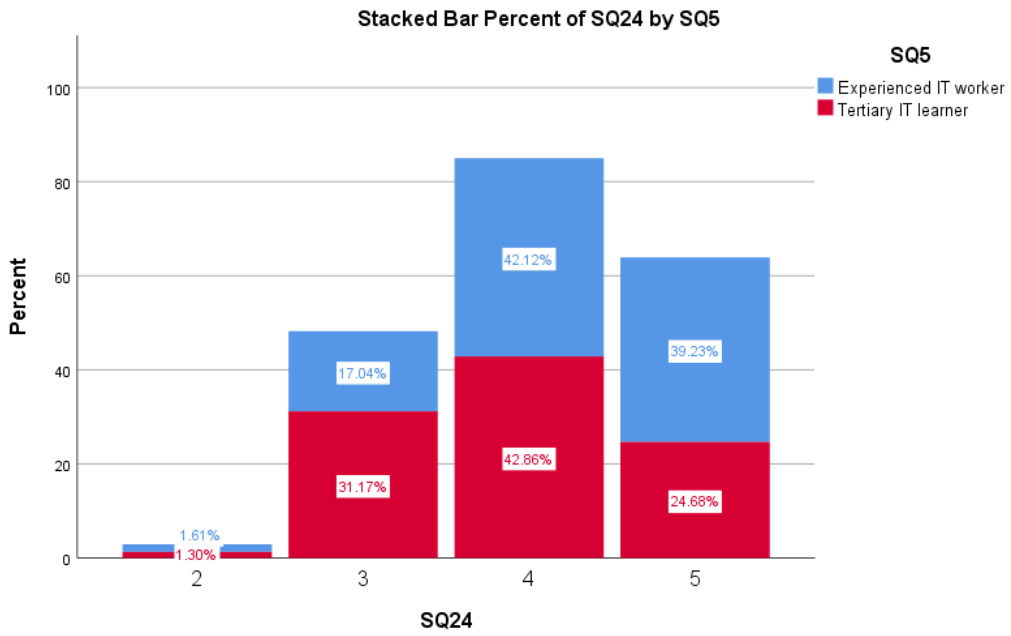

Figure 82 Stacked Bar Percent of SQ24 by SQ5_Occupation

Table 59 and Figure 79 represent that most participants choose “Mostly satisfied” and “Completely satisfied” at 42.3% and 36.3%. So, it can conclude that most IT professional (78.6%) think it is easy to use updated functions. Figure 80 shows that regardless of age group, most people choose “Mostly satisfied”, with slightly higher numbers in the 18-25 and 36-45 age groups. Figure 81 reflects more female choose “Completely satisfied” and more male determine “Mostly satisfied”. Figure 82 indicates that most experienced IT workers choose “Completely satisfied” and “Mostly satisfied”, at 39.23% and 42.12%, respectively. Most tertiary IT learners choose “Neutral” and “Mostly satisfied”, at 31.17% and 42.86%, respectively.

4.1.3 Chi-square Test

In Chi-square test, to determine whether category variables are independent of each other, the p-values can be compared to a significance level. Normally, a significance level (expressed as alpha or α) of 0.05 is sufficient. A significance level of 0.05 indicates that there is a 5% risk of concluding that an association exists when the variables are not actually associated with each other.

If the p-value is less than or equal to the significance level, then the original hypothesis (H_0) can be rejected and the association between the variables can be concluded to be statistically significant.

If the p-value is higher than the significance level, the original hypothesis (H_0) cannot be rejected because there is insufficient evidence to conclude that there is an association between the variables.

4.1.3.1 Analysis of Category Variables: Age*Survey Questions

Age*SQ 8 How easy is it to install and configure the data visualization tools that you use? (Related to user interface)

H_0: Age is not associated with SQ 8

H_1: Age is associated with SQ 8

Case Processing Summary						
	Valid		Cases Missing		Total	
	N	Percent	N	Percent	N	Percent
SQ1 * SQ8	388	100.0%	0	0.0%	388	100.0%

Table 60 Case Processing Summary: Number of Respondents to SQ 8

SQ 1 * SQ 8 Crosstabulation							
			SQ 8				Total
			2	3	4	5	
SQ 1	18 – 25	Count	0	14	32	59	105
		Expected Count	.5	9.2	40.3	54.9	105.0
	26 – 35	Count	2	16	92	126	236
		Expected Count	1.2	20.7	90.6	123.5	236.0

	36 – 45	Count	0	4	13	14	31
		Expected Count	.2	2.7	11.9	16.2	31.0
	Over 45	Count	0	0	12	4	16
		Expected Count	.1	1.4	6.1	8.4	16.0
Total		Count	2	34	149	203	388
		Expected Count	2.0	34.0	149.0	203.0	388.0

Table 61 SQ 1_Age * SQ 8 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	17.217 [a]	9	.045
Likelihood Ratio	18.446	9	.030
N of Valid Cases	388		
a. **6 cells (37.5%) have expected count less than 5. The minimum expected count is .08.**			

Table 62 Chi-Square Tests for SQ1_Age * SQ 8

From Table 62 Chi-Square Tests for SQ1_Age * SQ 8, the corresponding p-value of the test statistic is p = 0.045. Since the p-value is less than chosen significance level (0.05), the researcher rejects the null hypothesis. Rather, the researcher concludes that there is a relationship between age and SQ 8.

*Age*SQ 9 How easy is it to navigate through the data visualization tool that you use? (Related to user interface)*

H0: Age is not associated with SQ 9

H1: Age is associated with SQ 9

Case Processing Summary						
	Valid		Cases Missing		Total	
	N	Percent	N	Percent	N	Percent
SQ1 * SQ9	388	100.0%	0	0.0%	388	100.0%

Table 63 Case Processing Summary: Number of Respondents to SQ 9

SQ 1 * SQ 9 Crosstabulation								
			SQ 9					Total
			1	2	3	4	5	
SQ 1	18 – 25	Count	1	3	5	44	52	105
		Expected Count	.3	1.4	11.1	43.0	49.3	105.0
	26 – 35	Count	0	2	26	92	116	236
		Expected Count	.6	3.0	24.9	96.7	110.7	236.0
	36 – 45	Count	0	0	5	14	12	31
		Expected Count	.1	.4	3.3	12.7	14.5	31.0
	Over 45	Count	0	0	5	9	2	16
		Expected Count	.0	.2	1.7	6.6	7.5	16.0
Total		Count	1	5	41	159	182	388
		Expected Count	1.0	5.0	41.0	159.0	182.0	388.0

Table 64 SQ 1_Age * SQ 9 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	22.624 [a]	12	.031
Likelihood Ratio	22.775	12	.030
N of Valid Cases	388		
a. **10cells (50.0%) have expected count less than 5. The minimum expected count is .04.**			

Table 65 Chi-Square Tests for SQ1_Age * SQ 9

From Table 65 Chi-Square Tests for SQ1_Age * SQ 9, the corresponding p-value of the test statistic is p = 0.031. Since the p-value is less than chosen significance level (0.05), the researcher rejects the null hypothesis. Rather, the researcher concludes that there is a relationship between age and SQ 9.

*Age*SQ 10 How easy is it to find specific commands in the data visualization tools that you use? (Related to user interface)*

H_0: Age is not associated with SQ 10

H_1: Age is associated with SQ 10

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ1 *	N	Percent	N	Percent	N	Percent
SQ10	388	100.0%	0	0.0%	388	100.0%

Table 66 Case Processing Summary: Number of Respondents to SQ 10

SQ 1 * SQ 10 Crosstabulation							
			SQ 10				
			2	3	4	5	Total
SQ 1	18 – 25	Count	2	17	52	34	105
		Expected Count	2.4	21.9	44.4	36.3	105.0
	26 – 35	Count	6	50	92	88	236
		Expected Count	5.5	49.3	99.8	81.5	236.0
	36 – 45	Count	1	8	12	10	31
		Expected Count	.7	6.5	13.1	10.7	31.0
	Over 45	Count	0	6	8	2	16
		Expected Count	.4	3.3	6.8	5.5	16.0
Total		Count	9	81	164	134	388
		Expected Count	9.0	81.0	164.0	134.0	388.0

Table 67 SQ 1_Age * SQ 10 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	9.388 [a]	9	.402
Likelihood Ratio	10.075	9	.344
N of Valid Cases	388		
a. **4 cells (25.0%) have expected count less than 5. The minimum expected count is .37.**			

Table 68 Chi-Square Tests for SQ1_Age * SQ 10

From Table 68 Chi-Square Tests for SQ1_Age * SQ 10, the corresponding p-value of the test statistic is p = 0.402. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between age and SQ 10.

Age*SQ 11 How easy is it to work with multiple tables in the data visualization tools that you use? (Related to user interface)

H_0: Age is not associated with SQ 11

H_1: Age is associated with SQ 11

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ1 *	N	Percent	N	Percent	N	Percent
SQ11	388	100.0%	0	0.0%	388	100.0%

Table 69 Case Processing Summary: Number of Respondents to SQ 11

SQ 1 * SQ 11 Crosstabulation							
			SQ 11				Total
			2	3	4	5	
SQ 1	18 – 25	Count	1	13	44	47	105
		Expected Count	2.4	16.8	42.8	43.0	105.0
	26 – 35	Count	6	42	95	93	236
		Expected Count	5.5	37.7	96.1	96.7	236.0
	36 – 45	Count	2	5	11	13	31
		Expected Count	.7	5.0	12.6	12.7	31.0
	Over 45	Count	0	2	8	6	16
		Expected Count	.4	2.6	6.5	6.6	16.0
Total		Count	9	62	158	159	388
		Expected Count	9.0	62.0	158.0	159.0	388.0

Table 70 SQ 1_Age * SQ 11 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.169 [a]	9	.723
Likelihood Ratio	6.074	9	.732
N of Valid Cases	388		
a. **5 cells (31.3%) have expected count less than 5. The minimum expected count is .37.**			

Table 71 Chi-Square Tests for SQ1_Age * SQ 11

From Table 71 Chi-Square Tests for SQ1_Age * SQ 11, the corresponding p-value of the test statistic is p = 0.723. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between age and SQ 11.

*Age*SQ 12 How easy is it to visualize data into graphs in the data visualization tools that you use? (Related to user interface)*

H_0: Age is not associated with and SQ 12

H_1: Age is associated with and SQ 12

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ1 *	N	Percent	N	Percent	N	Percent
SQ12	388	100.0%	0	0.0%	388	100.0%

Table 72 Case Processing Summary: Number of Respondents to SQ 12

SQ 1 * SQ 12 Crosstabulation							
			SQ 12				Total
			2	3	4	5	
SQ 1	18 – 25	Count	1	10	34	60	105
		Expected Count	2.4	9.5	35.5	57.6	105.0
	26 – 35	Count	6	19	81	130	236
		Expected Count	5.5	21.3	79.7	129.6	236.0
	36 – 45	Count	1	5	10	15	31
		Expected Count	.7	2.8	10.5	17.0	31.0
	Over 45	Count	1	1	6	8	16
		Expected Count	.4	1.4	5.4	8.8	16.0
Total		Count	9	35	131	213	388
		Expected Count	9.0	35.0	131.0	213.0	388.0

Table 73 SQ 1_Age * SQ 12 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.796 [a]	9	.852
Likelihood Ratio	4.388	9	.884
N of Valid Cases	388		
a. **5 cells (31.3%) have expected count less than 5. The minimum expected count is .37.**			

Table 74 Chi-Square Tests for SQ1_Age * SQ 12

From Table 74 Chi-Square Tests for SQ1_Age * SQ 12, the corresponding p-value of the test statistic is p = 0.852. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between age and SQ 12.

*Age*SQ 13 How easy is it extract/import data from data sources in the data visualization tools that you use? (Related to data source connection)*

H0: Age is not associated with and SQ 13

H_1: Age is associated with and SQ 13

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ1 *	N	Percent	N	Percent	N	Percent
SQ13	388	100.0%	0	0.0%	388	100.0%

Table 75 Case Processing Summary: Number of Respondents to SQ 13

SQ 1 * SQ 13 Crosstabulation							
			SQ 13				Total
			2	3	4	5	
SQ 1	18 – 25	Count	2	13	35	55	105
		Expected Count	2.2	12.7	32.2	57.9	105.0
	26 – 35	Count	5	27	65	139	236
		Expected Count	4.9	28.6	72.4	130.2	236.0
	36 – 45	Count	1	5	11	14	31
		Expected Count	.6	3.8	9.5	17.1	31.0
	Over 45	Count	0	2	8	6	16
		Expected Count	.3	1.9	4.9	8.8	16.0
Total		Count	8	47	119	214	388
		Expected Count	8.0	47.0	119.0	214.0	388.0

Table 76 SQ 1_Age * SQ 13 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.450 [a]	9	.694
Likelihood Ratio	6.548	9	.684
N of Valid Cases	388		
a. **7 cells (43.8%) have expected count less than 5. The minimum expected count is .33.**			

Table 77 Chi-Square Tests for SQ1_Age * SQ 13

From Table 77 Chi-Square Tests for SQ1_Age * SQ 13, the corresponding p-value of the test statistic is p = 0.694. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between age and SQ 13.

*Age*SQ 14 How easy is it to transform the data in the data visualization tools that you use? (Related to data source connection)*

H_0: Age is not associated with SQ 14

H_1: Age is associated with SQ 14

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ1 *	N	Percent	N	Percent	N	Percent
SQ14	388	100.0%	0	0.0%	388	100.0%

Table 78 Case Processing Summary: Number of Respondents to SQ 14

SQ 1 * SQ 14 Crosstabulation							
			SQ 14				Total
			2	3	4	5	
SQ 1	18 – 25	Count	2	26	32	45	105
		Expected Count	3.2	17.3	40.6	43.8	105.0
	26 – 35	Count	8	29	100	99	236
		Expected Count	7.3	38.9	91.2	98.5	236.0
	36 – 45	Count	1	7	9	14	31
		Expected Count	1.0	5.1	12.0	12.9	31.0
	Over 45	Count	1	2	9	4	16
		Expected Count	.5	2.6	6.2	6.7	16.0
Total		Count	12	64	150	162	388
		Expected Count	12.0	64.0	150.0	162.0	388.0

Table 79 SQ 1_Age * SQ 14 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	14.676 [a]	9	.100
Likelihood Ratio	14.445	9	.107
N of Valid Cases	388		
a. **4 cells (25.0%) have expected count less than 5. The minimum expected count is .49.**			

Table 80 Chi-Square Tests forSQ1_ Age * SQ 14

From Table 80 Chi-Square Tests forSQ1_ Age * SQ 14, the corresponding p-value of the test statistic is p = 0.100. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between age and SQ 14.

*Age*SQ 15 Is training on the data visualization tools that you use available and accessible to all users? (Related to help documentation)*

H_0: Age is not associated with SQ 15

H_1: Age is associated with SQ 15

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ1 *	N	Percent	N	Percent	N	Percent
SQ15	388	100.0%	0	0.0%	388	100.0%

Table 81 Case Processing Summary: Number of Respondents to SQ 15

SQ 1 * SQ 15 Crosstabulation						
			SQ 15			
			Neutral	No	Yes	Total
SQ 1	18 – 25	Count	15	13	77	105
		Expected Count	21.6	11.6	71.7	105.0
	26 – 35	Count	54	25	157	236
		Expected Count	48.7	26.2	161.2	236.0
	36 – 45	Count	5	3	23	31
		Expected Count	6.4	3.4	21.2	31.0
	Over 45	Count	6	2	8	16
		Expected Count	3.3	1.8	10.9	16.0
Total		Count	80	43	265	388
		Expected Count	80.0	43.0	265.0	388.0

Table 82 SQ 1_Age * SQ 15 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.878 [a]	6	.332
Likelihood Ratio	6.761	6	.344
N of Valid Cases	388		
a. **3 cells (25.0%) have expected count less than 5. The minimum expected count is 1.77.**			

Table 83 Chi-Square Tests for SQ1_Age * SQ 15

From Table 83 Chi-Square Tests for SQ1_Age * SQ 15, the corresponding p-value of the test statistic is p = 0.332. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between age and SQ 15.

*Age*SQ 16 Are there self-paced tutorials on the data visualization tools that you use that user can access? (Related to help documentation)*

H_0: Age is not associated with SQ 16

H_1: Age is associated with SQ 16

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ1 *	N	Percent	N	Percent	N	Percent
SQ16	388	100.0%	0	0.0%	388	100.0%

Table 84 Case Processing Summary: Number of Respondents to SQ 16

SQ 1 * SQ 16 Crosstabulation						
			SQ 16			Total
			Neutral	No	Yes	
SQ 1	18 – 25	Count	15	7	83	105
		Expected Count	13.8	7.6	83.6	105.0
	26 – 35	Count	27	18	191	236
		Expected Count	31.0	17.0	187.9	236.0
	36 – 45	Count	5	1	25	31
		Expected Count	4.1	2.2	24.7	31.0
	Over 45	Count	4	2	10	16
		Expected Count	2.1	1.2	12.7	16.0
Total		Count	51	28	309	388
		Expected Count	51.0	28.0	309.0	388.0

Table 85 SQ 1_Age * SQ 16 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.597 [a]	6	.596
Likelihood Ratio	4.357	6	.629
N of Valid Cases	388		
a. **4 cells (33.3%) have expected count less than 5. The minimum expected count is 1.15.**			

Table 86 Chi-Square Tests for SQ1_Age * SQ 16

From Table 86 Chi-Square Tests for SQ1_Age * SQ 16, the corresponding p-value of the test statistic is p = 0.596. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between age and SQ 16.

Age*SQ 17 Within the data visualization tools that you use, how easy is it for user to search and find answers to software-specific questions? (Related to help documentation)

H_0: Age is not associated with SQ 17

H_1: Age is associated with SQ 17

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ1 *	N	Percent	N	Percent	N	Percent
SQ17	388	100.0%	0	0.0%	388	100.0%

Table 87 Case Processing Summary: Number of Respondents to SQ 17

SQ 1 * SQ 17 Crosstabulation								
			SQ 17					
			1	2	3	4	5	Total
SQ 1	18 - 25	Count	1	5	25	47	27	105
		Expected Count	.5	4.3	25.2	46.5	28.4	105.0
	26 - 35	Count	1	8	57	102	68	236
		Expected Count	1.2	9.7	56.6	104.6	63.9	236.0
	36 - 45	Count	0	3	6	15	7	31
		Expected Count	.2	1.3	7.4	13.7	8.4	31.0
	Over 45	Count	0	0	5	8	3	16
		Expected Count	.1	.7	3.8	7.1	4.3	16.0
Total		Count	2	16	93	172	105	388
		Expected Count	2.0	16.0	93.0	172.0	105.0	388.0

Table 88 SQ 1_Age * SQ 17 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	5.971 [a]	12	.918
Likelihood Ratio	6.209	12	.905
N of Valid Cases	388		
a. **9 cells (45.0%) have expected count less than 5. The minimum expected count is .08.**			

Table 89 Chi-Square Tests for SQ1_Age * SQ 17

From Table 89 Chi-Square Results for Age * SQ 17, the corresponding p-value of the test statistic is p = 0.918. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between age and SQ 17.

*Age*SQ 18 Is there a robust and active user community accessible to share and learn best practices, tips, etc.? (Related to help documentation)*

H_0: Age is not associated with SQ 18

H_1: Age is associated with SQ 18

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ1 *	N	Percent	N	Percent	N	Percent
SQ18	388	100.0%	0	0.0%	388	100.0%

Table 90 Case Processing Summary: Number of Respondents to SQ 18

SQ 1 * SQ 18 Crosstabulation						
			SQ 18			Total
			Neutral	No	Yes	
SQ 1	18 - 25	Count	16	9	80	105
		Expected Count	16.2	8.1	80.6	105.0
	26 - 35	Count	35	15	186	236
		Expected Count	36.5	18.2	181.3	236.0
	36 - 45	Count	6	5	20	31
		Expected Count	4.8	2.4	23.8	31.0
	Over 45	Count	3	1	12	16
		Expected Count	2.5	1.2	12.3	16.0
Total		Count	60	30	298	388
		Expected Count	60.0	30.0	298.0	388.0

Table 91 SQ 1_Age * SQ 18 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.771 [a]	6	.573
Likelihood Ratio	4.134	6	.659
N of Valid Cases	388		
a. **4 cells (33.3%) have expected count less than 5. The minimum expected count is 1.24.**			

Table 92 Chi-Square Tests for SQ1_Age * SQ 18

From Table 92 Chi-Square Tests for SQ1_Age * SQ 18, the corresponding p-value of the test statistic is p = 0.573. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between age and SQ 18.

*Age*SQ 19 Does it have free version/free trial? (Related to pricing package)*

H_0: Age is not associated with SQ 19

H_1: Age is associated with SQ 19

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ1 * SQ19	N	Percent	N	Percent	N	Percent
	388	100.0%	0	0.0%	388	100.0%

Table 93 Case Processing Summary: Number of Respondents to SQ 19

SQ 1 * SQ 19 Crosstabulation						
			SQ 19			
			Neutral	No	Yes	Total
SQ 1	18 - 25	Count	10	12	83	105
		Expected Count	11.1	7.3	86.8	105.0
	26 - 35	Count	20	11	205	236
		Expected Count	24.9	16.4	194.6	236.0
	36 - 45	Count	7	3	21	31
		Expected Count	3.3	2.2	25.6	31.0
	Over 45	Count	4	1	11	16
		Expected Count	1.7	1.1	13.2	16.0
Total		Count	41	27	320	388
		Expected Count	41.0	27.0	320.0	388.0

Table 94 SQ 1_Age * SQ 19 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	15.502 [a]	6	.017
Likelihood Ratio	13.419	6	.037
N of Valid Cases	388		
a. **4 cells (33.3%) have expected count less than 5. The minimum expected count is 1.11.**			

Table 95 Chi-Square Tests for SQ1_Age * SQ 19

From Table 95 Chi-Square Tests for SQ1_Age * SQ 19, the corresponding p-value of the test statistic is p = 0.017. Since the p-value is less than chosen significance level (0.05), the researcher rejects the null hypothesis. Rather, the researcher concludes that there is a relationship between age and SQ 19.

*Age*SQ 20 Are the available licensing options clear and transparent? (Related to pricing package)*

H_0: Age is not associated with SQ 20

H_1: Age is associated with SQ 20

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ1 * SQ20	N	Percent	N	Percent	N	Percent
	388	100.0%	0	0.0%	388	100.0%

Table 96 Case Processing Summary: Number of Respondents to SQ 20

SQ 1 * SQ 20 Crosstabulation						
			SQ 20			Total
			Neutral	No	Yes	
SQ 1	18 - 25	Count	21	7	77	105
		Expected Count	17.6	4.6	82.8	105.0
	26 - 35	Count	32	8	196	236
		Expected Count	39.5	10.3	186.1	236.0
	36 - 45	Count	8	1	22	31
		Expected Count	5.2	1.4	24.4	31.0
	Over 45	Count	4	1	11	16
		Expected Count	2.7	.7	12.6	16.0
Total		Count	65	17	306	388
		Expected Count	65.0	17.0	306.0	388.0

Table 97 SQ 1_Age * SQ 20 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7.652 [a]	6	.265
Likelihood Ratio	7.295	6	.294
N of Valid Cases	388		
a. **4 cells (33.3%) have expected count less than 5. The minimum expected count is .70.**			

Table 98 Chi-Square Tests for SQ1_Age * SQ 20

From Table 98 Chi-Square Tests for SQ1_Age * SQ 20, the corresponding p-value of the test statistic is p = 0.265. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between age and SQ 20.

*Age*SQ 21 Is the pricing model for the software easy to understand? (Related to pricing package)*

H_0: Age is not associated with SQ 21

H_1: Age is associated with SQ 21

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ1 * SQ21	N	Percent	N	Percent	N	Percent
	388	100.0%	0	0.0%	388	100.0%

Table 99 Case Processing Summary: Number of Respondents to SQ 21

SQ 1 * SQ 21 Crosstabulation						
			SQ 21			Total
			Neutral	No	Yes	
SQ 1	18 - 25	Count	25	7	73	105
		Expected Count	22.7	7.6	74.7	105.0
	26 - 35	Count	43	16	177	236
		Expected Count	51.1	17.0	167.9	236.0
	36 - 45	Count	12	1	18	31
		Expected Count	6.7	2.2	22.1	31.0
	Over 45	Count	4	4	8	16
		Expected Count	3.5	1.2	11.4	16.0
Total		Count	84	28	276	388
		Expected Count	84.0	28.0	276.0	388.0

Table 100 SQ 1_Age * SQ 21 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	15.844 [a]	6	.015
Likelihood Ratio	12.687	6	.048
N of Valid Cases	388		
a. **3 cells (25.0%) have expected count less than 5. The minimum expected count is 1.15.**			

Table 101 Chi-Square Tests for SQ1_Age * SQ 21

From Table 101 Chi-Square Tests for SQ1_Age * SQ 21, the corresponding p-value of the test statistic is p = 0.015. Since the p-value is less than chosen significance level (0.05), the researcher rejects the null hypothesis. Rather, the researcher concludes that there is a relationship between age and SQ 21.

*Age*SQ 22 Is the pricing model for the software flexible and scalable? (Related to pricing package)*

H_0: Age is not associated with d SQ 22

H_1: Age is associated with SQ 22

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ1 * SQ22	N	Percent	N	Percent	N	Percent
	388	100.0%	0	0.0%	388	100.0%

Table 102 Case Processing Summary: Number of Respondents to SQ 22

SQ 1 * SQ 22 Crosstabulation						
			SQ 22			Total
			Neutral	No	Yes	
SQ 1	18 - 25	Count	38	7	60	105
		Expected Count	29.5	8.9	66.6	105.0
	26 - 35	Count	57	22	157	236
		Expected Count	66.3	20.1	149.6	236.0
	36 - 45	Count	9	3	19	31
		Expected Count	8.7	2.6	19.7	31.0
	Over 45	Count	5	1	10	16
		Expected Count	4.5	1.4	10.1	16.0
Total		Count	109	33	246	388
		Expected Count	1.9.0	33.0	246.0	388.0

Table 103 SQ 1_Age * SQ 22 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	5.606 [a]	6	.469
Likelihood Ratio	5.515	6	.480
N of Valid Cases	388		
a. **3 cells (25.0%) have expected count less than 5. The minimum expected count is 1.36.**			

Table 104 Chi-Square Tests for SQ1_Age * SQ 22

From Table 104 Chi-Square Tests for SQ1_Age * SQ 22, the corresponding p-value of the test statistic is p = 0.469. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between age and SQ 22.

*Age*SQ 23 How often does it update the functionalities? (Related to updates of functionality)*

H_0: Age is not associated with and SQ 23

H_1: Age is associated with and SQ 23

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ1 * SQ23	N	Percent	N	Percent	N	Percent
	388	100.0%	0	0.0%	388	100.0%

Table 105 Case Processing Summary: Number of Respondents to SQ 23

SQ 1 * SQ 23 Crosstabulation									
			SQ 23						
			Every six months	Every three months	Never	Not focus on it	Once a month	Once a year	Total
SQ 1	18 - 25	Count	9	20	1	35	36	4	105
		Expected Count	7.0	20.0	.8	31.9	39.2	6.0	105.0
	26 - 35	Count	15	46	2	66	93	14	236
		Expected Count	15.8	45.0	1.8	71.8	88.2	13.4	236.0
	36 - 45	Count	2	6	0	10	11	2	31
		Expected Count	2.1	5.9	.2	9.4	11.6	1.8	31.0
	Over 45	Count	0	2	0	7	5	2	16
		Expected Count	1.1	3.1	.1	4.9	6.0	.9	16.0
Total		Count	26	74	3	118	145	22	388
		Expected Count	26.0	74.0	3.0	118.0	145.0	22.0	388.0

Table 106 SQ 1_Age * SQ 23 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.942 [a]	15	.959
Likelihood Ratio	8.027	15	.923
N of Valid Cases	388		
a. **10 cells (41.7%) have expected count less than 5. The minimum expected count is .12.**			

Table 107 Chi-Square Tests for SQ1_Age * SQ 23

From Table 107 Chi-Square Tests for SQ1_Age * SQ 23, the corresponding p-value

of the test statistic is p = 0.959. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between age and SQ 23.

*Age*SQ 24 How easy is it to use updated functionalities? (Related to update of functionality)*

H_0: Age is not associated with and SQ 24

H_1: Age is associated with and SQ 24

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ1 *	N	Percent	N	Percent	N	Percent
SQ24	388	100.0%	0	0.0%	388	100.0%

Table 108 Case Processing Summary: Number of Respondents to SQ 24

SQ 1 * SQ 24 Crosstabulation							
			SQ 24				
			2	3	4	5	Total
SQ 1	18 - 25	Count	0	24	47	34	105
		Expected Count	1.6	20.8	44.4	38.2	105.0
	26 - 35	Count	5	41	95	95	236
		Expected Count	3.6	46.8	99.8	85.8	236.0
	36 - 45	Count	0	7	15	9	31
		Expected Count	.5	6.2	13.1	11.3	31.0
	Over 45	Count	1	5	7	3	16
		Expected Count	.2	3.2	6.8	5.8	16.0
Total		Count	6	77	164	141	388
		Expected Count	6.0	77.0	164.0	141.0	388.0

Table 109 SQ 1_Age * SQ 24 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11.194 [a]	9	.263
Likelihood Ratio	12.393	9	.192
N of Valid Cases	388		
a. **5 cells (31.3%) have expected count less than 5. The minimum expected count is .25.**			

Table 110 Chi-Square Tests for SQ1_Age * SQ 24

From Table 110 Chi-Square Tests for SQ1_Age * SQ 24, the corresponding p-value of the test statistic is p = 0.263. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between age and SQ 24.

4.1.3.2 Analysis of Category Variables: Gender*Survey Questions

Gender*SQ 8 How easy is it to install and configure the data visualization tools that you use? (Related to user interface)

H_0: Gender is not associated with SQ 8

H_1: Gender is associated with SQ 8

Case Processing Summary						
	Valid		Cases Missing		Total	
	N	Percent	N	Percent	N	Percent
SQ2 * SQ8	388	100.0%	0	0.0%	388	100.0%

Table 111 Case Processing Summary: Number of Respondents to SQ 8

SQ 2 * SQ 8 Crosstabulation							
			SQ 8				
			2	3	4	5	Total
SQ 2	Female	Count	2	5	32	60	99
		Expected Count	.5	8.7	38.0	51.8	99.0
	Male	Count	0	29	116	142	287
		Expected Count	1.5	25.1	110.2	150.2	287.0
	Prefer not to say	Count	0	0	1	1	2
		Expected Count	.0	.2	.8	1.0	2.0
Total		Count	2	34	149	203	388
		Expected Count	2.0	34.0	149.0	203.0	388.0

Table 112 SQ 2_Gender * SQ 8 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11.231 [a]	6	.081
Likelihood Ratio	11.275	6	.080
N of Valid Cases	388		
a. **6 cells (50.0%) have expected count less than 5. The minimum expected count is .01.**			

Table 113 Chi-Square Tests for SQ2_Gender * SQ 8

From Table 113 Chi-Square Tests for SQ2_Gender * SQ 8, the corresponding p-value of the test statistic is p = 0.081. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between gender and SQ 8.

Gender*SQ 9 How easy is it to navigate through the data visualization tool that you use? (Related to user interface)

H_0: Gender is not associated with SQ 9

H_1: Gender is associated with SQ 9

Case Processing Summary						
	Valid		Cases Missing		Total	
	N	Percent	N	Percent	N	Percent
SQ2 * SQ9	388	100.0%	0	0.0%	388	100.0%

Table 114 Case Processing Summary: Number of Respondents to SQ 9

SQ 2 * SQ 9 Crosstabulation								
			SQ 9					Total
			1	2	3	4	5	
SQ 2	Female	Count	0	1	8	39	51	99
		Expected Count	.3	1.3	10.5	40.6	46.4	99.0
	Male	Count	1	4	33	119	130	287
		Expected Count	.7	3.7	30.3	117.6	134.6	287.0
	Prefer not to say	Count	0	0	0	1	1	2
		Expected Count	.0	.0	.2	.8	.9	2.0
Total		Count	1	5	41	159	182	388
		Expected Count	1.0	5.0	41.0	159.0	182.0	388.0

Table 115 SQ 2_Gender * SQ 9 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2.216 [a]	8	.974
Likelihood Ratio	2.739	8	.950
N of Valid Cases	388		
a. **9 cells (60.0%) have expected count less than 5. The minimum expected count is .01.**			

Table 116 Chi-Square Tests for SQ2_Gender * SQ 9

From Table 116 Chi-Square Tests for SQ2_Gender * SQ 9, the corresponding p-value of the test statistic is p = 0.974. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between gender and SQ 9.

Gender*SQ 10 How easy is it to find specific commands in the data visualization tools that you use? (Related to user interface)

H_0: Gender is not associated with SQ 10

H_1: Gender is associated with SQ 10

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ2 *	N	Percent	N	Percent	N	Percent
SQ10	388	100.0%	0	0.0%	388	100.0%

Table 117 Case Processing Summary: Number of Respondents to SQ 10

SQ 2 * SQ 10 Crosstabulation							
			SQ 10				
			2	3	4	5	Total
SQ 2	Female	Count	2	19	37	41	99
		Expected Count	2.3	20.7	41.8	34.2	99.0
	Male	Count	7	62	125	93	287
		Expected Count	6.7	59.9	121.3	99.1	287.0
	Prefer not to say	Count	0	0	2	0	2
		Expected Count	.0	.4	.8	.7	2.0
Total		Count	9	81	164	134	388
		Expected Count	9.0	81.0	164.0	134.0	388.0

Table 118 SQ 2_Gender * SQ 10 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	5.402 [a]	6	.493
Likelihood Ratio	6.067	6	.416
N of Valid Cases	388		
a. **5 cells (41.7%) have expected count less than 5. The minimum expected count is .05.**			

Table 119 Chi-Square Tests for SQ2_Gender * SQ 10

From Table 119 Chi-Square Tests for SQ2_Gender * SQ 10, the corresponding p-value of the test statistic is p = 0.493. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between gender and SQ 10.

*Gender*SQ 11 How easy is it to work with multiple tables in the data visualization tools that you use? (Related to user interface)*

H_0: Gender is not associated with SQ 11

H_1: Gender is associated with SQ 11

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ2 *	N	Percent	N	Percent	N	Percent
SQ11	388	100.0%	0	0.0%	388	100.0%

Table 120 Case Processing Summary: Number of Respondents to SQ 11

SQ 2 * SQ 11 Crosstabulation							
			SQ 11				Total
			2	3	4	5	
SQ 2	Female	Count	4	17	34	44	99
		Expected Count	2.3	15.8	40.3	40.6	99.0
	Male	Count	5	45	123	114	287
		Expected Count	6.7	45.9	116.9	117.6	287.0
	Prefer not to say	Count	0	0	1	1	2
		Expected Count	.0	.3	.8	.8	2.0
Total		Count	9	62	158	159	388
		Expected Count	9.0	62.0	158.0	159.0	388.0

Table 121 SQ 2_Gender * SQ 11 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3.940 [a]	6	.685
Likelihood Ratio	4.150	6	.656
N of Valid Cases	388		
a. **5 cells (41.7%) have expected count less than 5. The minimum expected count is .05.**			

Table 122 Chi-Square Tests for SQ2_Gender * SQ 11

From Table 122 Chi-Square Tests for SQ2_Gender * SQ 11, the corresponding p-value of the test statistic is p = 0.685. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between gender and SQ 11.

Gender*SQ 12 How easy is it to visualize data into graphs in the data visualization tools that you use? (Related to user interface)

H_0: Gender is not associated with SQ 12

H_1: Gender is associated with SQ 12

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ2 * SQ12	N	Percent	N	Percent	N	Percent
	388	100.0%	0	0.0%	388	100.0%

Table 123 Case Processing Summary: Number of Respondents to SQ 12

SQ 2 * SQ 12 Crosstabulation							
			SQ 12				Total
			2	3	4	5	
SQ 2	Female	Count	3	5	33	58	99
		Expected Count	2.3	8.9	33.4	54.3	99.0
	Male	Count	6	30	97	154	287
		Expected Count	6.7	25.9	96.9	157.6	287.0
	Prefer not to say	Count	0	0	1	1	2
		Expected Count	.0	.2	.7	1.1	2.0
Total		Count	9	35	131	213	388
		Expected Count	9.0	35.0	131.0	213.0	388.0

Table 124 SQ 2_Gender * SQ 12 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3.386 [a]	6	.759
Likelihood Ratio	3.870	6	.694
N of Valid Cases	388		
a. **5 cells (41.7%) have expected count less than 5. The minimum expected count is .05.**			

Table 125 Chi-Square Tests for SQ2_Gender * SQ 12

From Table 125 Chi-Square Tests for SQ2_Gender * SQ 12, the corresponding p-value of the test statistic is p = 0.759. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between gender and SQ 12.

Gender*SQ 13 How easy is it extract/import data from data sources in the data visualization tools that you use? (Related to data source connection)

H_0: Gender is not associated with SQ 13

H_1: Gender is associated with SQ 13

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ2 * SQ13	N	Percent	N	Percent	N	Percent
	388	100.0%	0	0.0%	388	100.0%

Table 126 Case Processing Summary: Number of Respondents to SQ 13

SQ 2 * SQ 13 Crosstabulation							
			SQ 13				Total
			2	3	4	5	
SQ 2	Female	Count	5	8	27	59	99
		Expected Count	2.0	12.0	30.4	54.6	99.0
	Male	Count	3	39	90	155	287
		Expected Count	5.9	34.8	88.0	158.3	287.0
	Prefer not to say	Count	0	0	2	0	2
		Expected Count	.0	.2	.6	1.1	2.0
Total		Count	8	47	119	214	388
		Expected Count	8.0	47.0	119.0	214.0	388.0

Table 127 SQ 2_Gender * SQ 13 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	12.933 [a]	6	.044
Likelihood Ratio	12.377	6	.054
N of Valid Cases	388		
a. **5 cells (41.7%) have expected count less than 5. The minimum expected count is .04.**			

Table 128 Chi-Square Tests for SQ2_Gender * SQ 13

From Table 128 Chi-Square Tests for SQ2_Gender * SQ 13, the corresponding p-value of the test statistic is p = 0.044. Since the p-value is less than chosen significance level (0.05), the researcher rejects the null hypothesis. Rather, the researcher concludes that there is a relationship between gender and SQ 13.

*Gender*SQ 14 How easy is it to transform the data in the data visualization tools that you use? (Related to data source connection)*

H_0: Gender is not associated with SQ 14

H_1: Gender is associated with SQ 14

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ2 *	N	Percent	N	Percent	N	Percent
SQ14	388	100.0%	0	0.0%	388	100.0%

Table 129 Case Processing Summary: Number of Respondents to SQ 14

SQ 2 * SQ 14 Crosstabulation							
			SQ 14				Total
			2	3	4	5	
SQ 2	Female	Count	5	11	31	51	99
		Expected Count	3.1	16.3	38.3	41.3	99.0
	Male	Count	7	53	117	110	287
		Expected Count	8.9	47.3	111.0	119.8	287.0
	Prefer not to say	Count	0	0	1	1	2
		Expected Count	.1	.3	.8	.8	2.0
Total		Count	12	64	150	162	388
		Expected Count	12.0	64.0	150.0	162.0	388.0

Table 130 SQ 2_Gender * SQ 14 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	8.955 [a]	6	.176
Likelihood Ratio	9.294	6	.158
N of Valid Cases	388		
a. **5 cells (41.7%) have expected count less than 5. The minimum expected count is .06.**			

Table 131 Chi-Square Tests for SQ2_Gender * SQ 14

From Table 131 Chi-Square Tests for SQ2_Gender * SQ 14, the corresponding p-value of the test statistic is p = 0.176. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between gender and SQ 14.

Gender*SQ 15 Is training on the data visualization tools that you use available and accessible to all users? (Related to help documentation)

H_0: Gender is not associated with SQ 15

H_1: Gender is associated with SQ 15

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ2 * SQ15	N	Percent	N	Percent	N	Percent
	388	100.0%	0	0.0%	388	100.0%

Table 132 Case Processing Summary: Number of Respondents to SQ 15

SQ 2 * SQ 15 Crosstabulation						
			SQ 15			
			Neutral	No	Yes	Total
SQ 2	Female	Count	16	14	69	99
		Expected Count	20.4	11.0	67.6	99.0
	Male	Count	64	29	194	287
		Expected Count	59.2	31.8	196.0	287.0
	Prefer not to say	Count	0	0	2	2
		Expected Count	.4	.2	1.4	2.0
Total		Count	80	43	265	388
		Expected Count	80.0	43.0	265.0	388.0

Table 133 SQ 2_Gender * SQ 15 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3.408 [a]	4	.492
Likelihood Ratio	4.012	4	.404
N of Valid Cases	388		
a. **3 cells (33.3%) have expected count less than 5. The minimum expected count is .22.**			

Table 134 Chi-Square Tests for SQ2_Gender * SQ 15

From Table 134 Chi-Square Tests for SQ2_Gender * SQ 15, the corresponding p-value of the test statistic is p = 0.492. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between gender and SQ 15.

Gender*SQ 16 Are there self-paced tutorials on the data visualization tools that you use that user can access? (Related to help documentation)

H_0: Gender is not associated with SQ 16

H_1: Gender is associated with SQ 16

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ2 *	N	Percent	N	Percent	N	Percent
SQ16	388	100.0%	0	0.0%	388	100.0%

Table 135 Case Processing Summary: Number of Respondents to SQ 16

SQ 2 * SQ 16 Crosstabulation						
			SQ 16			
			Neutral	No	Yes	Total
SQ 2	Female	Count	13	9	77	99
		Expected Count	13.0	7.1	78.8	99.0
	Male	Count	38	19	230	287
		Expected Count	37.7	20.7	228.6	287.0
	Prefer not to say	Count	0	0	2	2
		Expected Count	.3	.1	1.6	2.0
Total		Count	51	28	309	388
		Expected Count	51.0	28.0	309.0	388.0

Table 136 SQ 2_Gender * SQ 16 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.189 [a]	4	.880
Likelihood Ratio	1.556	4	.817
N of Valid Cases	388		
a. **3 cells (33.3%) have expected count less than 5. The minimum expected count is . 41.**			

Table 137 Chi-Square Tests for SQ2_Gender * SQ 16

From Table 137 Chi-Square Tests for SQ2_Gender * SQ 16, the corresponding p-value of the test statistic is p = 0.880. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between gender and SQ 16.

Gender*SQ 17 Within the data visualization tools that you use, how easy is it for user to search and find answers to software-specific questions? (Related to help documentation)

H_0: Gender is not associated with SQ 17

H_1: Gender is associated with SQ 17

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ2 * SQ17	N	Percent	N	Percent	N	Percent
	388	100.0%	0	0.0%	388	100.0%

Table 138 Case Processing Summary: Number of Respondents to SQ 17

SQ 2 * SQ 17 Crosstabulation								
			SQ 17					
			1	2	3	4	5	Total
SQ 2	Female	Count	1	4	22	43	29	99
		Expected Count	.5	4.1	23.7	43.9	26.8	99.0
	Male	Count	1	12	71	128	75	287
		Expected Count	1.5	11.8	68.8	127.2	77.7	287.0
	Prefer not to say	Count	0	0	0	1	1	2
		Expected Count	.0	.1	.5	.9	.5	2.0
Total		Count	2	16	93	172	105	388
		Expected Count	2.0	16.0	93.0	172.0	105.0	388.0

Table 139 SQ 2_Gender * SQ 17 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2.098 [a]	8	.978
Likelihood Ratio	2.506	8	.961
N of Valid Cases	388		
a. **8 cells (53.3%) have expected count less than 5. The minimum expected count is .01.**			

Table 140 Chi-Square Tests for SQ2_Gender * SQ 17

From Table 140 Chi-Square Tests for SQ2_Gender * SQ 17, the corresponding p-value of the test statistic is p = 0.978. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between gender and SQ 17.

Gender*SQ 18 Is there a robust and active user community accessible to share and learn best practices, tips, etc.? (Related to help documentation)

H_0: Gender is not associated with SQ 18

H_1: Gender is associated with SQ 18

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ2 *	N	Percent	N	Percent	N	Percent
SQ18	388	100.0%	0	0.0%	388	100.0%

Table 141 Case Processing Summary: Number of Respondents to SQ 18

SQ 2 * SQ 18 Crosstabulation						
			SQ 18			
			Neutral	No	Yes	Total
SQ 2	Female	Count	15	11	73	99
		Expected Count	15.3	7.7	76.0	99.0
	Male	Count	44	19	224	287
		Expected Count	44.4	22.2	220.4	287.0
	Prefer not to say	Count	1	0	1	2
		Expected Count	.3	.2	1.5	2.0
Total		Count	60	30	298	388
		Expected Count	60	30.0	298.0	388.0

Table 142 SQ 2_Gender * SQ 18 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3.994 [a]	4	.407
Likelihood Ratio	3.447	4	.486
N of Valid Cases	388		
a. **3 cells (33.3%) have expected count less than 5. The minimum expected count is .15.**			

Table 143 Chi-Square Tests for SQ2_Gender * SQ 18

From Table 143 Chi-Square Tests for SQ2_Gender * SQ 18, the corresponding p-value of the test statistic is p = 0.407. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between gender and SQ 18.

*Gender*SQ 19 Does it have free version/free trial? (Related to pricing package)*

H_0: Gender is not associated with SQ 19

H_1: Gender is associated with SQ 19

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ2 * SQ19	N	Percent	N	Percent	N	Percent
	388	100.0%	0	0.0%	388	100.0%

Table 144 Case Processing Summary: Number of Respondents to SQ 19

SQ 2 * SQ 19 Crosstabulation						
			SQ 19			
			Neutral	No	Yes	Total
SQ 2	Female	Count	6	6	87	99
		Expected Count	10.5	6.9	81.6	99.0
	Male	Count	35	21	231	287
		Expected Count	30.3	20.0	236.7	287.0
	Prefer not to say	Count	0	0	2	2
		Expected Count	.2	.1	1.6	2.0
Total		Count	41	27	320	388
		Expected Count	41.0	27.0	320.0	388.0

Table 145 SQ 2_Gender * SQ 19 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3.703 [a]	4	.448
Likelihood Ratio	4.362	4	.359
N of Valid Cases	388		
a. **3 cells (33.3%) have expected count less than 5. The minimum expected count is .14.**			

Table 146 Chi-Square Tests for SQ2_Gender * SQ 19

From Table 146 Chi-Square Tests for SQ2_Gender * SQ 19, the corresponding p-value of the test statistic is p = 0.448. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between gender and SQ 19.

*Gender*SQ 20 Are the available licensing options clear and transparent? (Related to pricing package)*

H_0: Gender is not associated with SQ 20

H_1: Gender is associated with SQ 20

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ2 * SQ20	N	Percent	N	Percent	N	Percent
	388	100.0%	0	0.0%	388	100.0%

Table 147 Case Processing Summary: Number of Respondents to SQ 20

SQ 2 * SQ 20 Crosstabulation						
			SQ 20			
			Neutral	No	Yes	Total
SQ 2	Female	Count	19	1	79	99
		Expected Count	16.6	4.3	78.1	99.0
	Male	Count	45	16	226	287
		Expected Count	48.1	12.6	226.3	287.0
	Prefer not to say	Count	1	0	1	2
		Expected Count	.3	.1	1.6	2.0
Total		Count	65	17	306	388
		Expected Count	65.0	17.0	306.0	388.0

Table 148 SQ 2_Gender * SQ 20 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	5.680 [a]	4	.224
Likelihood Ratio	6.423	4	.170
N of Valid Cases	388		
a. **4 cells (44.4%) have expected count less than 5. The minimum expected count is .09.**			

Table 149 Chi-Square Tests for SQ2_Gender * SQ 20

From Table 149 Chi-Square Tests for SQ2_Gender * SQ 20, the corresponding p-value of the test statistic is p = 0.224. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between gender and SQ 20.

*Gender*SQ 21 Is the pricing model for the software easy to understand? (Related to pricing package)*

H_0: Gender is not associated with SQ 21

H_1: Gender is associated with SQ 21

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ2 *	N	Percent	N	Percent	N	Percent
SQ21	388	100.0%	0	0.0%	388	100.0%

Table 150 Case Processing Summary: Number of Respondents to SQ 21

SQ 2 * SQ 21 Crosstabulation						
			SQ 21			
			Neutral	No	Yes	Total
SQ 2	Female	Count	28	4	67	99
		Expected Count	21.4	7.1	70.4	99.0
	Male	Count	56	24	207	287
		Expected Count	62.1	20.7	204.2	287.0
	Prefer not to say	Count	0	0	2	2
		Expected Count	.4	.1	1.4	2.0
Total		Count	84	28	276	388
		Expected Count	84.0	28.0	276.0	388.0

Table 151 SQ 2_Gender * SQ 21 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	5.541 [a]	4	.236
Likelihood Ratio	6.176	4	.186
N of Valid Cases	388		
a. **3 cells (33.3%) have expected count less than 5. The minimum expected count is .14.**			

Table 152 Chi-Square Tests for SQ2_Gender * SQ 21

From Table 152 Chi-Square Tests for SQ2_Gender * SQ 21, the corresponding p-value of the test statistic is p = 0.236. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between gender and SQ 21.

*Gender*SQ 22 Is the pricing model for the software flexible and scalable? (Related to pricing package)*

H_0: Gender is not associated with SQ 22

H_1: Gender is associated with SQ 22

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ2 *	N	Percent	N	Percent	N	Percent
SQ22	388	100.0%	0	0.0%	388	100.0%

Table 153 Case Processing Summary: Number of Respondents to SQ 22

SQ 2 * SQ 22 Crosstabulation						
			SQ 22			
			Neutral	No	Yes	Total
SQ 2	Female	Count	32	7	60	99
		Expected Count	27.8	8.4	62.8	99.0
	Male	Count	77	26	184	287
		Expected Count	80.6	24.4	182.0	287.0
	Prefer not to say	Count	0	0	2	2
		Expected Count	.6	.2	1.3	2.0
Total		Count	109	33	246	388
		Expected Count	109.0	33.0	246.0	388.0

Table 154 SQ 2_Gender * SQ 22 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2.436 [a]	4	.656
Likelihood Ratio	3.093	4	.543
N of Valid Cases	388		
a. **3 cells (33.3%) have expected count less than 5. The minimum expected count is .17.**			

Table 155 Chi-Square Tests for SQ2_Gender * SQ 22

From Table 155 Chi-Square Tests for SQ2_Gender * SQ 22, the corresponding p-value of the test statistic is p = 0.656. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between gender and SQ 22.

*Gender*SQ 23 How often does it update the functionalities? (Related to updates of functionality)*

H_0: Gender is not associated with SQ 23

H_1: Gender is associated with SQ 23

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ2 *	N	Percent	N	Percent	N	Percent
SQ23	388	100.0%	0	0.0%	388	100.0%

Table 156 Case Processing Summary: Number of Respondents to SQ 23

SQ 2 * SQ 23 Crosstabulation									
			SQ 23						
			Every six months	Every three months	Never	Not focus on it	Once a month	Once a year	Total
SQ 2	Female	Count	8	14	2	31	42	2	99
		Expected Count	6.6	18.9	.8	30.1	37.0	5.6	99.0
	Male	Count	18	60	1	86	102	20	287
		Expected Count	19.2	54.7	2.2	87.3	107.3	16.3	287.0
	Prefer not to say	Count	0	0	0	1	1	0	2
		Expected Count	.1	.4	.0	.6	.7	.1	2.0
Total		Count	26	74	3	118	145	22	388
		Expected Count	26.0	74.0	3.0	118.0	145.0	22.0	388.0

Table 157 SQ 2_Gender * SQ 23 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	9.930 [a]	10	.447
Likelihood Ratio	10.864	10	.368
N of Valid Cases	388		
a. **8 cells (44.4%) have expected count less than 5. The minimum expected count is .02.**			

Table 158 Chi-Square Tests for SQ2_Gender * SQ 23

From Table 158 Chi-Square Tests for SQ2_Gender * SQ 23, the corresponding p-value of the test statistic is p = 0.447. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the

researcher concludes that there is no relationship between gender and SQ 23.

*Gender*SQ 24 How easy is it to use updated functionalities? (Related to updates of functionality)*

H_0: Gender is not associated with SQ 24

H_1: Gender is associated with SQ 24

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ2 *	N	Percent	N	Percent	N	Percent
SQ24	388	100.0%	0	0.0%	388	100.0%

Table 159 Case Processing Summary: Number of Respondents to SQ 24

SQ 2 * SQ 24 Crosstabulation							
			SQ 24				Total
			2	3	4	5	
SQ 2	Female	Count	3	19	31	46	99
		Expected Count	1.5	19.6	41.8	36.0	99.0
	Male	Count	3	58	131	95	287
		Expected Count	4.4	57.0	121.3	104.3	287.0
	Prefer not to say	Count	0	0	2	0	2
		Expected Count	.0	.4	.8	.7	2.0
Total		Count	6	77	164	141	388
		Expected Count	6.0	77.0	164.0	141.0	388.0

Table 160 SQ 2_Gender * SQ 24 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11.854 [a]	6	.065
Likelihood Ratio	12.374	6	.054
N of Valid Cases	388		
a. **6 cells (50.0%) have expected count less than 5. The minimum expected count is .03.**			

Table 161 Chi-Square Tests for SQ2_Gender * SQ 24

From Table 161 Chi-Square Tests for SQ2_Gender * SQ 24, the corresponding p-value of the test statistic is p = 0.065. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between gender and SQ 24.

4.1.3.3 Analysis of Category Variables: Occupation*Survey Questions

Occupation*SQ 8 How easy is it to install and configure the data visualization tools that you use? (Related to user interface)

H_0: Occupation is not associated with SQ 8

H_1: Occupation is associated with SQ 8

Case Processing Summary						
	Valid		Cases Missing		Total	
	N	Percent	N	Percent	N	Percent
SQ5 * SQ8	388	100.0%	0	0.0%	388	100.0%

Table 162 Case Processing Summary: Number of Respondents to SQ 8

SQ 5 * SQ 8 Crosstabulation							
			SQ 8				
			2	3	4	5	Total
SQ 5	Experienced IT worker	Count	1	26	121	163	311
		Expected Count	1.6	27.3	119.4	162.7	311.0
	Tertiary IT learner	Count	1	8	28	40	77
		Expected Count	.4	6.7	29.6	40.3	77.0
Total		Count	2	34	149	203	388
		Expected Count	2.0	34.0	149.0	203.0	388.0

Table 163 SQ 5_Occupation * SQ 8 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.540 [a]	3	.673
Likelihood Ratio	1.290	3	.732
N of Valid Cases	388		
a. **2 cells (25.0%) have expected count less than 5. The minimum expected count is .40.**			

Table 164 Chi-Square Tests for SQ5_Occupation * SQ 8

From Table 164 Chi-Square Tests for SQ5_Occupation * SQ 8, the corresponding p-value of the test statistic is p = 0.673. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between occupation and SQ 8.

Occupation*SQ 9 How easy is it to navigate through the data visualization tool that you use? (Related to user interface)

H_0: Occupation is not associated with SQ 9

H_1: Occupation is associated with SQ 9

Case Processing Summary						
	Valid		Cases Missing		Total	
	N	Percent	N	Percent	N	Percent
SQ5 * SQ9	388	100.0%	0	0.0%	388	100.0%

Table 165 Case Processing Summary: Number of Respondents to SQ 9

SQ 5 * SQ 9 Crosstabulation								
			SQ 9					Total
			1	2	3	4	5	
SQ 5	Experienced IT worker	Count	0	3	30	127	151	311
		Expected Count	.8	4.0	32.9	127.4	145.9	311.0
	Tertiary IT learner	Count	1	2	11	32	31	77
		Expected Count	.2	1.0	8.1	31.6	36.1	77.0
Total		Count	1	5	41	159	182	388
		Expected Count	1.0	5.0	41.0	159.0	182.0	388.0

Table 166 SQ 5_Occupation * SQ 9 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7.486 [a]	4	.112
Likelihood Ratio	6.412	4	.170
N of Valid Cases	388		
a. **4 cells (40.0%) have expected count less than 5. The minimum expected count is .20.**			

Table 167 Chi-Square Tests for SQ5_Occupation * SQ 9

From Table 167 Chi-Square Tests for SQ5_Occupation * SQ 9, the corresponding p-value of the test statistic is p = 0.112. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between occupation and SQ 9.

*Occupation*SQ 10 How easy is it to find specific commands in the data visualization tools that you use? (Related to user interface)*

H_0: Occupation is not associated with SQ 10

H_1: Occupation is associated with SQ 10

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ5 *	N	Percent	N	Percent	N	Percent
SQ10	388	100.0%	0	0.0%	388	100.0%

Table 168 Case Processing Summary: Number of Respondents to SQ 10

SQ 5 * SQ 10 Crosstabulation							
			SQ 10				Total
			2	3	4	5	
SQ 5	Experienced IT worker	Count	6	59	137	109	311
		Expected Count	7.2	64.9	131.5	107.4	311.0
	Tertiary IT learner	Count	3	22	27	25	77
		Expected Count	1.8	16.1	32.5	26.6	77.0
Total		Count	9	81	164	134	388
		Expected Count	9.0	81.0	164.0	134.0	388.0

Table 169 SQ 5_Occupation * SQ 10 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	5.052 [a]	3	.168
Likelihood Ratio	4.771	3	.189
N of Valid Cases	388		
a. **1 cell (12.5%) have expected count less than 5. The minimum expected count is 1.79.**			

Table 170 Chi-Square Tests for SQ5_Occupation * SQ 10

From Table 170 Chi-Square Tests for SQ5_Occupation * SQ 10, the corresponding p-value of the test statistic is p = 0.168. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between occupation and SQ 10.

Occupation*SQ 11 How easy is it to work with multiple tables in the data visualization tools that you use? (Related to user interface)

H_0: Occupation is not associated with SQ 11

H_1: Occupation is associated with SQ 11

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ5 *	N	Percent	N	Percent	N	Percent
SQ11	388	100.0%	0	0.0%	388	100.0%

Table 171 Case Processing Summary: Number of Respondents to SQ 11

SQ 5 * SQ 11 Crosstabulation							
			SQ 11				Total
			2	3	4	5	
SQ 5	Experienced IT worker	Count	7	44	132	128	311
		Expected Count	7.2	49.7	126.6	127.4	311.0
	Tertiary IT learner	Count	2	18	26	31	77
		Expected Count	1.8	12.3	31.4	31.6	77.0
Total		Count	9	62	158	159	388
		Expected Count	9.0	62.0	158.0	159.0	388.0

Table 172 SQ 5_Occupation * SQ 11 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.475 [a]	3	.215
Likelihood Ratio	4.222	3	.238
N of Valid Cases	388		
a. **1 cell (12.5%) have expected count less than 5. The minimum expected count is 1.79.**			

Table 173 Chi-Square Tests for SQ5_Occupation * SQ 11

From Table 173 Chi-Square Tests for SQ5_Occupation * SQ 11, the corresponding p-value of the test statistic is p = 0.215. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between occupation and SQ 11.

Occupation*SQ 12 How easy is it to visualize data into graphs in the data visualization tools that you use? (Related to user interface)

H_0: Occupation is not associated with SQ 12

H_1: Occupation is associated with SQ 12

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ5 *	N	Percent	N	Percent	N	Percent
SQ12	388	100.0%	0	0.0%	388	100.0%

Table 174 Case Processing Summary: Number of Respondents to SQ 12

SQ 5 * SQ 12 Crosstabulation							
			SQ 12				
			2	3	4	5	Total
SQ 5	Experienced IT worker	Count	7	27	105	172	311
		Expected Count	7.2	28.1	105.0	170.7	311.0
	Tertiary IT learner	Count	2	8	26	41	77
		Expected Count	1.8	6.9	26.0	42.3	77.0
Total		Count	9	35	131	213	388
		Expected Count	9.0	35.0	131.0	213.0	388.0

Table 175 SQ 5_Occupation * SQ 12 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.279 [a]	3	.964
Likelihood Ratio	.272	3	.965
N of Valid Cases	388		
a. **1 cell (12.5%) have expected count less than 5. The minimum expected count is 1.79.**			

Table 176 Chi-Square Tests for SQ5_Occupation * SQ 12

From Table 176 Chi-Square Tests for SQ5_Occupation * SQ 12, the corresponding p-value of the test statistic is p = 0.964. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between occupation and SQ 12.

Occupation*SQ 13 How easy is it extract/import data from data sources in the data visualization tools that you use? (Related to data source connection)

H_0: Occupation is not associated with SQ 13

H_1: Occupation is associated with SQ 13

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ5 *	N	Percent	N	Percent	N	Percent
SQ13	388	100.0%	0	0.0%	388	100.0%

Table 177 Case Processing Summary: Number of Respondents to SQ 13

SQ 5 * SQ 13 Crosstabulation							
			SQ 13				Total
			2	3	4	5	
SQ 5	Experienced IT worker	Count	6	39	91	175	311
		Expected Count	6.4	37.7	95.4	171.5	311.0
	Tertiary IT learner	Count	2	8	28	39	77
		Expected Count	1.6	9.3	23.6	42.5	77.0
Total		Count	8	47	119	214	388
		Expected Count	8.0	47.0	119.0	214.0	388.0

Table 178 SQ 5_Occupation * SQ 13 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.738 [a]	3	.628
Likelihood Ratio	1.704	3	.636
N of Valid Cases	388		
a. **1 cell (12.5%) have expected count less than 5. The minimum expected count is 1.59.**			

Table 179 Chi-Square Tests for SQ5_Occupation * SQ 13

From Table 179 Chi-Square Tests for SQ5_Occupation * SQ 13, the corresponding p-value of the test statistic is p = 0.628. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between occupation and SQ 13.

Occupation*SQ 14 How easy is it to transform the data in the data visualization tools that you use? (Related to data source connection)

H_0: Occupation is not associated with SQ 14

H_1: Occupation is associated with SQ 14

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ5 *	N	Percent	N	Percent	N	Percent
SQ14	388	100.0%	0	0.0%	388	100.0%

Table 180 Case Processing Summary: Number of Respondents to SQ 14

SQ 5 * SQ 14 Crosstabulation							
			SQ 14				Total
			2	3	4	5	
SQ 5	Experienced IT worker	Count	10	42	125	134	311
		Expected Count	9.6	51.3	120.2	129.9	311.0
	Tertiary IT learner	Count	2	22	25	28	77
		Expected Count	2.4	12.7	29.8	32.1	77.0
Total		Count	12	64	150	162	388
		Expected Count	12.0	64.0	150.0	162.0	388.0

Table 181 SQ 5_Occupation * SQ 14 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10.191 [a]	3	.017
Likelihood Ratio	9.137	3	.028
N of Valid Cases	388		
a. **1 cell (12.5%) have expected count less than 5. The minimum expected count is 2.38.**			

Table 182 Chi-Square Tests for SQ5_Occupation * SQ 14

From Table 182 Chi-Square Tests for SQ5_Occupation * SQ 14, the corresponding p-value of the test statistic is p = 0.017. Since the p-value is less than chosen significance level (0.05), the researcher rejects the null hypothesis. Rather, the researcher concludes that there is a relationship between occupation and SQ 14.

Occupation*SQ 15 Is training on the data visualization tools that you use available and accessible to all users? (Related to help documentation)

H_0: Occupation is not associated with and SQ 15

H_1: Occupation is associated with and SQ 15

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ5 * SQ15	N	Percent	N	Percent	N	Percent
	388	100.0%	0	0.0%	388	100.0%

Table 183 Case Processing Summary: Number of Respondents to SQ 15

SQ 5 * SQ 15 Crosstabulation						
			SQ 15			Total
			Neutral	No	Yes	
SQ 5	Experienced IT worker	Count	54	39	218	311
		Expected Count	64.1	34.5	212.4	311.0
	Tertiary IT learner	Count	26	4	47	77
		Expected Count	15.9	8.5	52.6	77.0
Total		Count	80	43	265	388
		Expected Count	80.0	43.0	265.0	388.0

Table 184 SQ 5_Occupation * SQ 15 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11.800 [a]	2	.003
Likelihood Ratio	11.432	2	.003
N of Valid Cases	388		
a. **0 cells (0.00%) have expected count less than 5. The minimum expected count is 8.53.**			

Table 185 Chi-Square Tests for SQ5_Occupation * SQ 15

From Table 185 Chi-Square Tests for SQ5_Occupation * SQ 15, the corresponding p-value of the test statistic is p = 0.003. Since the p-value is less than chosen significance level (0.05), the researcher rejects the null hypothesis. Rather, the researcher concludes that there is a relationship between occupation and SQ 15.

Occupation*SQ 16 Are there self-paced tutorials on the data visualization tools that you use that user can access? (Related to help documentation)

H_0: Occupation is not associated with SQ 16

H_1: Occupation is associated with SQ 16

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ5 *	N	Percent	N	Percent	N	Percent
SQ16	388	100.0%	0	0.0%	388	100.0%

Table 186 Case Processing Summary: Number of Respondents to SQ 16

SQ 5 * SQ 16 Crosstabulation						
			SQ 16			
			Neutral	No	Yes	Total
SQ 5	Experienced IT worker	Count	41	24	246	311
		Expected Count	40.9	22.3	247.7	311.0
	Tertiary IT learner	Count	10	4	63	77
		Expected Count	10.1	5.6	61.3	77.0
Total		Count	51	28	309	388
		Expected Count	51.0	28.0	309.0	388.0

Table 187 SQ 5_Occupation * SQ 16 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.603 [a]	2	.740
Likelihood Ratio	.648	2	.723
N of Valid Cases	388		
a. **0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.56.**			

Table 188 Chi-Square Tests for SQ5_Occupation * SQ 16

From Table 188 Chi-Square Tests for SQ5_Occupation * SQ 16, the corresponding p-value of the test statistic is p = 0.740. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between occupation and SQ 16.

Occupation*SQ 17 Within the data visualization tools that you use, how easy is it for user to search and find answers to software-specific questions? (Related to help documentation)

H_0: Occupation is not associated with SQ 17

H_1: Occupation is associated with SQ 17

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ5 *	N	Percent	N	Percent	N	Percent
SQ17	388	100.0%	0	0.0%	388	100.0%

Table 189 Case Processing Summary: Number of Respondents to SQ 17

SQ 5 * SQ 17 Crosstabulation								
			SQ 17					
			1	2	3	4	5	Total
SQ 5	Experienced IT worker	Count	2	10	69	140	90	311
		Expected Count	1.6	12.8	74.5	137.9	84.2	311.0
	Tertiary IT learner	Count	0	6	24	32	15	77
		Expected Count	.4	3.2	18.5	34.1	20.8	77.0
Total		Count	2	16	93	172	105	388
		Expected Count	2.0	16.0	93.0	172.0	105.0	388.0

Table 190 SQ 5_Occupation * SQ 17 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7.915 [a]	4	.095
Likelihood Ratio	7.867	4	.097
N of Valid Cases	388		
a. **3 cells (30.0%) have expected count less than 5. The minimum expected count is .40.**			

Table 191 Chi-Square Tests for SQ5_Occupation * SQ 17

From Table 191 Chi-Square Tests for SQ5_Occupation * SQ 17, the corresponding p-value of the test statistic is p = 0.095. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between occupation and SQ 17.

Occupation*SQ 18 Is there a robust and active user community accessible to share and learn best practices, tips, etc.? (Related to help documentation)

H_0: Occupation is not associated with SQ 18

H_1: Occupation is associated with SQ 18

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ5 *	N	Percent	N	Percent	N	Percent
SQ18	388	100.0%	0	0.0%	388	100.0%

Table 192 Case Processing Summary: Number of Respondents to SQ 18

SQ 5 * SQ 18 Crosstabulation						
			SQ 18			Total
			Neutral	No	Yes	
SQ 5	Experienced IT worker	Count	36	24	251	311
		Expected Count	48.1	24.0	238.9	311.0
	Tertiary IT learner	Count	24	6	47	77
		Expected Count	11.9	6.0	59.1	77.0
Total		Count	60	30	298	388
		Expected Count	60.0	30.0	298.0	388.0

Table 193 SQ 5_Occupation * SQ 18 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	18.431 [a]	2	.000
Likelihood Ratio	16.081	2	.000
N of Valid Cases	388		
a. **0 cells (0.00%) have expected count less than 5. The minimum expected count is 5.95.**			

Table 194 Chi-Square Tests for SQ5_Occupation * SQ 18

From Table 194 Chi-Square Tests for SQ5_Occupation * SQ 18, the corresponding p-value of the test statistic is p = 0.000. Since the p-value is less than chosen significance level (0.05), the researcher rejects the null hypothesis. Rather, the researcher concludes that there is a relationship between occupation and SQ 18.

*Occupation*SQ 19 Does it have free version/free trial? (Related to pricing package)*

H_0: Occupation is not associated with SQ 19

H_1: Occupation is associated with SQ 19

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ5 *	N	Percent	N	Percent	N	Percent
SQ19	388	100.0%	0	0.0%	388	100.0%

Table 195 Case Processing Summary: Number of Respondents to SQ 19

SQ 5 * SQ 19 Crosstabulation						
			SQ 19			
			Neutral	No	Yes	Total
SQ 5	Experienced IT worker	Count	30	25	256	311
		Expected Count	32.9	21.6	256.5	311.0
	Tertiary IT learner	Count	11	2	64	77
		Expected Count	8.1	5.4	63.5	77.0
Total		Count	41	27	320	388
		Expected Count	41.0	27.0	320.0	388.0

Table 196 SQ 5_Occupation * SQ 19 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3.888 [a]	2	.143
Likelihood Ratio	4.439	2	.109
N of Valid Cases	388		
a. **0 cells (0.00%) have expected count less than 5. The minimum expected count is 5.36.**			

Table 197 Chi-Square Tests for SQ5_Occupation * SQ 19

From Table 197 Chi-Square Tests for SQ5_Occupation * SQ 19, the corresponding p-value of the test statistic is p = 0.143. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between occupation and SQ 19.

Occupation*SQ 20 Are the available licensing options clear and transparent? (Related to pricing package)

H_0: Occupation is not associated with SQ 20

H_1: Occupation is associated with SQ 20

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ5 * SQ20	N	Percent	N	Percent	N	Percent
	388	100.0%	0	0.0%	388	100.0%

Table 198 Case Processing Summary: Number of Respondents to SQ 20

SQ 5 * SQ 20Crosstabulation						
			SQ 20			Total
			Neutral	No	Yes	
SQ 5	Experienced IT worker	Count	43	16	252	311
		Expected Count	52.1	13.6	245.3	311.0
	Tertiary IT learner	Count	22	1	54	77
		Expected Count	12.9	3.4	60.7	77.0
Total		Count	65	17	306	388
		Expected Count	65.0	17.0	306.0	388.0

Table 199 SQ 5_Occupation * SQ 20 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11.023 [a]	2	.004
Likelihood Ratio	10.644	2	.005
N of Valid Cases	388		
a. **1 cell (16.7%) have expected count less than 5. The minimum expected count is 3.37.**			

Table 200 Chi-Square Tests for SQ5_Occupation * SQ 20

From Table 200 Chi-Square Tests for SQ5_Occupation * SQ 20, the corresponding p-value of the test statistic is p = 0.004. Since the p-value is less than chosen significance level (0.05), the researcher rejects the null hypothesis. Rather, the researcher concludes that there is a relationship between occupation and SQ 20.

Occupation*SQ 21 Is the pricing model for the software easy to understand? (Related to pricing package)

H_0: Occupation is not associated with SQ 21

H_1: Occupation is associated with SQ 21

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ5 *	N	Percent	N	Percent	N	Percent
SQ21	388	100.0%	0	0.0%	388	100.0%

Table 201 Case Processing Summary: Number of Respondents to SQ 21

SQ 5 * SQ 21 Crosstabulation						
			SQ 21			
			Neutral	No	Yes	Total
SQ 5	Experienced IT worker	Count	61	24	226	311
		Expected Count	67.3	22.4	221.2	311.0
	Tertiary IT learner	Count	23	4	50	77
		Expected Count	16.7	5.6	54.8	77.0
Total		Count	84	28	276	388
		Expected Count	84.0	28.0	276.0	388.0

Table 202 SQ 5_Occupation * SQ 21 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.062 [a]	2	.131
Likelihood Ratio	3.881	2	.144
N of Valid Cases	388		
a. **0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.56.**			

Table 203 Chi-Square Tests for SQ5_Occupation * SQ 21

From Table 203 Chi-Square Tests for SQ5_Occupation * SQ 21, the corresponding p-value of the test statistic is p = 0.131. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between occupation and SQ 21.

*Occupation*SQ 22 Is the pricing model for the software flexible and scalable? (Related to pricing package)*

H_0: Occupation is not associated with SQ 22

H_1: Occupation is associated with SQ 22

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ5 * SQ22	N	Percent	N	Percent	N	Percent
	388	100.0%	0	0.0%	388	100.0%

Table 204 Case Processing Summary: Number of Respondents to SQ 22

SQ 5 * SQ 22 Crosstabulation						
			SQ 22			Total
			Neutral	No	Yes	
SQ 5	Experienced IT worker	Count	79	28	204	311
		Expected Count	87.4	26.5	197.2	311.0
	Tertiary IT learner	Count	30	5	42	77
		Expected Count	21.6	6.5	48.8	77.0
Total		Count	109	33	246	388
		Expected Count	109.0	33.0	246.0	388.0

Table 205 SQ 5_Occupation * SQ 22 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	5.685 [a]	2	.058
Likelihood Ratio	5.436	2	.066
N of Valid Cases	388		
a. **0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.55.**			

Table 206 Chi-Square Tests for SQ5_Occupation * SQ 22

From Table 206 Chi-Square Tests for SQ5_Occupation * SQ 22, the corresponding p-value of the test statistic is p = 0.058. Since the p-value is greater than chosen significance level (0.05), the researcher accepts the null hypothesis. Rather, the researcher concludes that there is no relationship between occupation and SQ 22.

*Occupation*SQ 23 How often does it update the functionalities? (Related to updates of functionality)*

H_0: Occupation is not associated with SQ 23

H_1: Occupation is associated with SQ 23

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ5 *	N	Percent	N	Percent	N	Percent
SQ23	388	100.0%	0	0.0%	388	100.0%

Table 207 Case Processing Summary: Number of Respondents to SQ 23

SQ 5 * SQ 23 Crosstabulation									
			SQ 23						
			Every six months	Every three months	Never	Not focus on it	Once a month	Once a year	Total
SQ 5	Experienced IT worker	Count	23	60	1	84	127	16	311
		Expected Count	20.8	59.3	2.4	94.6	116.2	17.6	311.0
	Tertiary IT learner	Count	3	14	2	34	18	6	77
		Expected Count	5.2	14.7	.6	23.4	28.8	4.4	77.0
Total		Count	26	74	3	118	145	22	388
		Expected Count	26.0	74.0	3.0	118.0	145.0	22.0	388.0

Table 208 SQ 5_Occupation * SQ 23 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	17.066 [a]	5	.004
Likelihood Ratio	16.171	5	.006
N of Valid Cases	388		
a. **3 cells (25.0%) have expected count less than 5. The minimum expected count is .06.**			

Table 209 Chi-Square Tests for SQ5_Occupation * SQ 23

From Table 209 Chi-Square Tests for SQ5_Occupation * SQ 23, the corresponding p-value of the test statistic is p = 0.004. Since the p-value is less than chosen significance level (0.05), the researcher rejects the null hypothesis. Rather, the researcher concludes that there is a relationship between occupation and SQ 23.

*Occupation*SQ 24 How easy is it to use updated functionalities? (Related to updates of functionality)*

H_0: Occupation is not associated with SQ 24

H_1: Occupation is associated with SQ 24

Case Processing Summary						
	Valid		Cases Missing		Total	
SQ5 *	N	Percent	N	Percent	N	Percent
SQ24	388	100.0%	0	0.0%	388	100.0%

Table 210 Case Processing Summary: Number of Respondents to SQ 24

SQ 5 * SQ 24 Crosstabulation							
			SQ 24				
			2	3	4	5	Total
SQ 5	Experienced IT worker	Count	5	53	131	122	311
		Expected Count	4.8	61.7	131.5	113.0	311.0
	Tertiary IT learner	Count	1	24	33	19	77
		Expected Count	1.2	15.3	32.5	28.0	77.0
Total		Count	6	77	164	141	388
		Expected Count	6.0	77.0	164.0	141.0	388.0

Table 211 SQ 5_Occupation * SQ 24 Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	9.850 [a]	3	.020
Likelihood Ratio	9.522	3	.023
N of Valid Cases	388		
a. **2 cells (25.0%) have expected count less than 5. The minimum expected count is 1.19.**			

Table 212 Chi-Square Tests for SQ5_Occupation * SQ 24

From Table 212 Chi-Square Tests for SQ5_Occupation * SQ 24, the corresponding p-value of the test statistic is p = 0.020. Since the p-value is less than chosen significance level (0.05), the researcher rejects the null hypothesis. Rather, the researcher concludes that there is a relationship between occupation and SQ 24.

After the Chi-square test, the researcher concludes the participants' age has a relationship with SQ 8 and 9, which relates to the user interface. Age also has a relationship with SQ 19 and 21, which refers to the pricing package. Other survey questions have no association with the age variable.

The gender variable only has a relationship with SQ 13, which relates to data source connections. Other survey questions have no association with gender.

The occupation variable has a relationship with SQ 14, 15, 18, 20, 23, and 24. SQ 14 relates to data source connection, SQ 15 and 18 relates to helping documentation, SQ 20 relates to pricing package, and SQ 23 and 24 relate to functionality updates. Other survey questions have no relationship with the occupation variable.

4.1.4 Three-way ANOVA

The researcher carries out a three-way ANOVA analysis to determine the age, gender, occupation, and interactions of these three independent variables to choose the data visualization tools by IT professionals. If the statistical significance level of the three-way interaction term is less than .05, which means there is a statistically significant three-way age*gender*occupation interaction effect. The results using three-way ANOVA have been shown below.

Age*Gender*Occupation: SQ 8 How easy is it to install and configure the data visualization tools that you use? (Related to user interface)

H_0: The interaction among age, gender and occupation does not affect the SQ8

H_1: The interaction among age, gender and occupation affects the SQ8

Between-Subjects Factors		
		N
SQ1_Age	18 - 25	105
	26 - 35	236
	36 - 45	31
	Over 45	16
SQ2_Gender	Female	99
	Male	287
	Prefer not to say	2
SQ5_Occupation	Experienced IT worker	311
	Tertiary IT learner	77

Table 213 Age*Gender*Occupation Factors for SQ 8

Tests of Between-Subjects Effects						
Dependent Variable: SQ8						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4.041[a]	16	.253	.549	.920	.023
Intercept	405.370	1	405.370	880.558	.000	.704
SQ1_Age	.569	3	.190	.412	.744	.003
SQ2_Gender	.108	2	.054	.117	.890	.001
SQ5_Occupation	.009	1	.009	.020	.888	.000
SQ1_Age *	.222	3	.074	.161	.923	.001

SQ2_Gender						
SQ1_Age * SQ5_Occupation	.181	3	.060	.131	.942	.001
SQ2_Gender * SQ5_Occupation	.027	1	.027	.058	.810	.000
SQ1_Age * SQ2_Gender * SQ5_Occupation	.514	2	.257	.558	.573	.003
Error	170.792	371	.460			
Total	7773.000	388				
Corrected Total	174.832	387				
a. R Squared = .023 (Adjusted R Squared = -.019)						

Table 214 ANOVA Tests of Between-Subjects Effects for Age*Gender*Occupation Factors and SQ 8

According to Table 214, the p value is .573, which is greater than .05. Therefore, there is not a statistically significant three-way interaction between age, gender and occupation with SQ 8.

*Age*Gender*Occupation: SQ 9 How easy is it to navigate through the data visualization tool that you use? (Related to user interface)*

H_0: The interaction among age, gender and occupation does not affect the SQ9

H_1: The interaction among age, gender and occupation affects the SQ9

Between-Subjects Factors		
		N
SQ1_Age	18 - 25	105
	26 - 35	236
	36 - 45	31
	Over 45	16
SQ2_Gender	Female	99
	Male	287
	Prefer not to say	2
SQ5_Occupation	Experienced IT worker	311
	Tertiary IT learner	77

Table 215 Age*Gender*Occupation Factors for SQ 9

Dependent Variable:	**SQ9**					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	14.650[a]	16	.916	1.741	.038	.070
Intercept	379.651	1	379.651	721.855	.000	.661
SQ1_Age	1.561	3	.520	.990	.398	.008
SQ2_Gender	.247	2	.124	.235	.791	.001
SQ5_Occupation	.277	1	.277	.527	.468	.001
SQ1_Age * SQ2_Gender	2.181	3	.727	1.382	.248	.011
SQ1_Age * SQ5_Occupation	.941	3	.314	.596	.618	.005
SQ2_Gender * SQ5_Occupation	.002	1	.002	.004	.951	.000
SQ1_Age * SQ2_Gender * SQ5_Occupation	.808	2	.404	.768	.465	.004
Error	195.123	371	.526			
Total	7484.000	388				
Corrected Total	209.773	387				
a. R Squared = .070 (Adjusted R Squared = .030)						

Table 216 ANOVA Tests of Between-Subjects Effects for Age*Gender*Occupation Factors and SQ 9

According to Table 216, the p value is .465, which is greater than .05. Therefore, there is not a statistically significant three-way interaction between age, gender and occupation with SQ 9.

*Age*Gender*Occupation: SQ 10 How easy is it to find specific commands in the data visualization tools that you use? (Related to user interface)*

H_0: The interaction among age, gender and occupation does not affect the SQ10

H_1: The interaction among age, gender and occupation affects the SQ10

Between-Subjects Factors		
		N
SQ1_Age	18 - 25	105
	26 - 35	236
	36 - 45	31
	Over 45	16
SQ2_Gender	Female	99
	Male	287
	Prefer not to say	2
SQ5_Occupation	Experienced IT worker	311
	Tertiary IT learner	77

Table 217 Age*Gender*Occupation Factors for SQ 10

Dependent Variable:	**SQ10**					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	16.211[a]	16	1.013	1.623	.060	.065
Intercept	322.972	1	322.972	517.298	.000	.582
SQ1_Age	2.569	3	.856	1.371	.251	.011
SQ2_Gender	.111	2	.055	.089	.915	.000
SQ5_Occupation	.919	1	.919	1.472	.226	.004
SQ1_Age * SQ2_Gender	4.684	3	1.561	2.501	.059	.020
SQ1_Age * SQ5_Occupation	1.886	3	.629	1.007	.390	.008
SQ2_Gender * SQ5_Occupation	.109	1	.109	.174	.677	.000
SQ1_Age * SQ2_Gender * SQ5_Occupation	3.377	2	1.688	2.704	.068	.014
Error	231.632	371	.624			
Total	6739.000	388				
Corrected Total	247.843	387				
a. R Squared = .065 (Adjusted R Squared = .025)						

Table 218 ANOVA Tests of Between-Subjects Effects for Age*Gender*Occupation Factors and SQ 10

According to Table 218, the p value is .068, which is greater than .05. Therefore, there is not a statistically significant three-way interaction between age, gender and occupation with SQ 10.

*Age*Gender*Occupation: SQ 11 How easy is it to work with multiple tables in the data visualization tools that you use? (Related to user interface)*

H_0: The interaction among age, gender and occupation does not affect the SQ11

H_1: The interaction among age, gender and occupation affects the SQ11

Between-Subjects Factors		
		N
SQ1_Age	18 - 25	105
	26 - 35	236
	36 - 45	31
	Over 45	16
SQ2_Gender	Female	99
	Male	287
	Prefer not to say	2
SQ5_Occupation	Experienced IT worker	311
	Tertiary IT learner	77

Table 219 Age*Gender*Occupation Factors for SQ 11

Dependent Variable:	**SQ11**					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	10.496[a]	16	.656	1.056	.396	.044
Intercept	361.048	1	361.048	581.328	.000	.610
SQ1_Age	2.708	3	.903	1.453	.227	.012
SQ2_Gender	.151	2	.075	.122	.886	.001
SQ5_Occupation	1.017	1	1.017	1.638	.201	.004
SQ1_Age * SQ2_Gender	.819	3	.273	.440	.725	.004
SQ1_Age * SQ5_Occupation	2.953	3	.984	1.585	.193	.013
SQ2_Gender * SQ5_Occupation	.018	1	.018	.029	.865	.000
SQ1_Age * SQ2_Gender * SQ5_Occupation	2.911	2	1.456	2.344	.097	.012
Error	230.419	371	.621			
Total	7097.000	388				
Corrected Total	240.915	387				
a. R Squared = .044 (Adjusted R Squared = .002)						

Table 220 ANOVA Tests of Between-Subjects Effects for Age*Gender*Occupation Factors and SQ 11

According to Table 220, the p value is .097, which is greater than .05. Therefore, there is not a statistically significant three-way interaction between age, gender and occupation with SQ 11.

*Age*Gender*Occupation: SQ 12 How easy is it to visualize data into graphs in the data visualization tools that you use? (Related to user interface)*

H_0: The interaction among age, gender and occupation does not affect the SQ12

H_1: The interaction among age, gender and occupation affects the SQ12

Between-Subjects Factors		
		N
SQ1_Age	18 - 25	105
	26 - 35	236
	36 - 45	31
	Over 45	16
SQ2_Gender	Female	99
	Male	287
	Prefer not to say	2
SQ5_Occupation	Experienced IT worker	311
	Tertiary IT learner	77

Table 221 Age*Gender*Occupation Factors for SQ 12

Dependent Variable:	**SQ12**					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	7.094[a]	16	.443	.780	.709	.033
Intercept	406.827	1	406.827	715.571	.000	.659
SQ1_Age	.427	3	.142	.250	.861	.002
SQ2_Gender	.669	2	.335	.589	.556	.003
SQ5_Occupation	3.688E-7	1	3.688E-7	.000	.999	.000
SQ1_Age * SQ2_Gender	1.433	3	.478	.840	.473	.007
SQ1_Age * SQ5_Occupation	1.506	3	.502	.883	.450	.007
SQ2_Gender * SQ5_Occupation	.579	1	.579	1.019	.314	.003
SQ1_Age * SQ2_Gender * SQ5_Occupation	1.270	2	.635	1.117	.328	.006
Error	210.926	371	.569			
Total	7772.000	388				
Corrected Total	218.021	387				
a. R Squared = .033 (Adjusted R Squared = -.009)						

Table 222 ANOVA Tests of Between-Subjects Effects for Age*Gender*Occupation Factors and SQ 12

According to Table 222, the p value is .328, which is greater than .05. Therefore, there is not a statistically significant three-way interaction between age, gender and occupation with SQ 12.

*Age*Gender*Occupation: SQ 13 How easy is it extract/import data from data sources in the data visualization tools that you use? (Related to data source connection)*

H_0: The interaction among age, gender and occupation does not affect the SQ13

H_1: The interaction among age, gender and occupation affects the SQ13

Between-Subjects Factors		
		N
SQ1_Age	18 - 25	105
	26 - 35	236
	36 - 45	31
	Over 45	16
SQ2_Gender	Female	99
	Male	287
	Prefer not to say	2
SQ5_Occupation	Experienced IT worker	311
	Tertiary IT learner	77

Table 223 Age*Gender*Occupation Factors for SQ 13

Tests of Between-Subjects Effects						
Dependent Variable:	**SQ13**					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	10.008[a]	16	.626	1.035	.418	.043
Intercept	386.388	1	386.388	639.309	.000	.633
SQ1_Age	.986	3	.329	.544	.653	.004
SQ2_Gender	.253	2	.127	.209	.811	.001
SQ5_Occupation	.056	1	.056	.093	.761	.000
SQ1_Age * SQ2_Gender	2.447	3	.816	1.350	.258	.011
SQ1_Age * SQ5_Occupation	2.022	3	.674	1.115	.343	.009
SQ2_Gender * SQ5_Occupation	.006	1	.006	.010	.921	.000
SQ1_Age * SQ2_Gender * SQ5_Occupation	5.212	2	2.606	4.312	.014	.023
Error	224.226	371	.604			
Total	7709.000	388				

Corrected Total	234.235	387				
a. R Squared = .043 (Adjusted R Squared = .001)						

Table 224 ANOVA Tests of Between-Subjects Effects for Age*Gender*Occupation Factors and SQ 13

According to Table 224, the p value is .014, which is less than .05. Therefore, there is a statistically significant three-way interaction between age, gender and occupation with SQ 13.

*Age*Gender*Occupation: SQ 14 How easy is it to transform the data in the data visualization tools that you use? (Related to data source connection)*

H_0: The interaction among age, gender and occupation does not affect the SQ14

H_1: The interaction among age, gender and occupation affects the SQ14

Between-Subjects Factors		
		N
SQ1_Age	18 - 25	105
	26 - 35	236
	36 - 45	31
	Over 45	16
SQ2_Gender	Female	99
	Male	287
	Prefer not to say	2
SQ5_Occupation	Experienced IT worker	311
	Tertiary IT learner	77

Table 225 Age*Gender*Occupation Factors for SQ 14

Dependent Variable: SQ14						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	15.675[a]	16	.980	1.488	.101	.060
Intercept	351.632	1	351.632	534.190	.000	.590
SQ1_Age	3.135	3	1.045	1.588	.192	.013
SQ2_Gender	.379	2	.190	.288	.750	.002
SQ5_Occupation	2.567	1	2.567	3.900	.049	.010
SQ1_Age * SQ2_Gender	1.831	3	.610	.927	.428	.007
SQ1_Age * SQ5_Occupation	5.268	3	1.756	2.668	.048	.021
SQ2_Gender * SQ5_Occupation	.155	1	.155	.235	.628	.001
SQ1_Age * SQ2_Gender * SQ5_Occupation	3.352	2	1.676	2.546	.080	.014
Error	244.212	371	.658			
Total	7074.000	388				
Corrected Total	259.887	387				
a. R Squared = .060 (Adjusted R Squared = .020)						

Table 226 ANOVA Tests of Between-Subjects Effects for Age*Gender*Occupation Factors and SQ 14

According to Table 226, the p value is .080, which is greater than .05. Therefore, there is not a statistically significant three-way interaction between age, gender and occupation with SQ 14.

*Age*Gender*Occupation: SQ 15 Is training on the data visualization tools that you use available and accessible to all users? (Related to help documentation)*

H_0: The interaction among age, gender and occupation does not affect the SQ15

H_1: The interaction among age, gender and occupation affects the SQ15

Between-Subjects Factors		
		N
SQ1_Age	18 - 25	105
	26 - 35	236
	36 - 45	31
	Over 45	16
SQ2_Gender	Female	99
	Male	287
	Prefer not to say	2
SQ5_Occupation	Experienced IT worker	311
	Tertiary IT learner	77

Table 227 Age*Gender*Occupation Factors for SQ 15

Dependent Variable:	**SQ15**					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	18.429[a]	16	1.152	1.793	.030	.072
Intercept	52.045	1	52.045	81.005	.000	.179
SQ1_Age	3.046	3	1.015	1.581	.194	.013
SQ2_Gender	1.066	2	.533	.830	.437	.004
SQ5_Occupation	1.497	1	1.497	2.329	.128	.006
SQ1_Age * SQ2_Gender	3.187	3	1.062	1.653	.177	.013
SQ1_Age * SQ5_Occupation	1.614	3	.538	.837	.474	.007
SQ2_Gender * SQ5_Occupation	.587	1	.587	.913	.340	.002
SQ1_Age * SQ2_Gender * SQ5_Occupation	4.629	2	2.314	3.602	.028	.019
Error	238.363	371	.642			
Total	1157.000	388				
Corrected Total	256.791	387				
a. R Squared = .072 (Adjusted R Squared = .032)						

Table 228 ANOVA Tests of Between-Subjects Effects for Age*Gender*Occupation Factors and SQ 15

According to Table 228, the p value is .028, which is less than .05. Therefore, there is a statistically significant three-way interaction between age, gender and occupation with SQ 15.

*Age*Gender*Occupation: SQ 16 Are there self-paced tutorials on the data visualization tools that you use that user can access? (Related to help documentation)*

H_0: The interaction among age, gender and occupation does not affect the SQ16

H_1: The interaction among age, gender and occupation affects the SQ16

Between-Subjects Factors		
		N
SQ1_Age	18 - 25	105
	26 - 35	236
	36 - 45	31
	Over 45	16
SQ2_Gender	Female	99
	Male	287
	Prefer not to say	2
SQ5_Occupation	Experienced IT worker	311
	Tertiary IT learner	77

Table 229 Age*Gender*Occupation Factors for SQ 16

Tests of Between-Subjects Effects						
Dependent Variable:	**SQ16**					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	8.555[a]	16	.535	1.132	.323	.047
Intercept	38.112	1	38.112	80.679	.000	.179
SQ1_Age	1.171	3	.390	.827	.480	.007
SQ2_Gender	1.032	2	.516	1.093	.336	.006
SQ5_Occupation	1.438	1	1.438	3.045	.082	.008
SQ1_Age * SQ2_Gender	1.442	3	.481	1.017	.385	.008
SQ1_Age * SQ5_Occupation	2.374	3	.791	1.675	.172	.013
SQ2_Gender * SQ5_Occupation	.907	1	.907	1.920	.167	.005
SQ1_Age * SQ2_Gender * SQ5_Occupation	2.959	2	1.480	3.132	.045	.017
Error	174.315	369	.472			
Total	862.000	386				
Corrected Total	182.870	385				
a. R Squared = .047 (Adjusted R Squared = .005)						

Table 230 ANOVA Tests of Between-Subjects Effects for Age*Gender*Occupation Factors and SQ 16

According to Table 230, the p value is .045, which is less than .05. Therefore, there is a statistically significant three-way interaction between age, gender and occupation with SQ 16.

Age*Gender*Occupation: SQ 17 Within the data visualization tools that you use, how easy is it for user to search and find answers to software-specific questions? (Related to help documentation)

H_0: The interaction among age, gender and occupation does not affect the SQ17

H_1: The interaction among age, gender and occupation affects the SQ17

Between-Subjects Factors		
		N
SQ1_Age	18 - 25	105
	26 - 35	236
	36 - 45	31
	Over 45	16
SQ2_Gender	Female	99
	Male	287
	Prefer not to say	2
SQ5_Occupation	Experienced IT worker	311
	Tertiary IT learner	77

Table 231 Age*Gender*Occupation Factors for SQ 17

Tests of Between-Subjects Effects						
Dependent Variable:	**SQ17**					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	13.337[a]	16	.834	1.167	.292	.048
Intercept	339.841	1	339.841	475.921	.000	.562
SQ1_Age	.934	3	.311	.436	.727	.004
SQ2_Gender	1.377	2	.689	.964	.382	.005
SQ5_Occupation	.955	1	.955	1.337	.248	.004
SQ1_Age * SQ2_Gender	.113	3	.038	.053	.984	.000
SQ1_Age * SQ5_Occupation	3.105	3	1.035	1.450	.228	.012
SQ2_Gender * SQ5_Occupation	.012	1	.012	.016	.899	.000
SQ1_Age * SQ2_Gender * SQ5_Occupation	1.702	2	.851	1.192	.305	.006
Error	264.920	371	.714			
Total	6280.000	388				
Corrected Total	278.258	387				

a. R Squared = .048 (Adjusted R Squared = .007)

Table 232 ANOVA Tests of Between-Subjects Effects for Age*Gender*Occupation Factors and SQ 17

According to Table 232, the p value is .305, which is greater than .05. Therefore, there is not a statistically significant three-way interaction between age, gender and occupation with SQ 17.

*Age*Gender*Occupation: SQ 18 Is there a robust and active user community accessible to share and learn best practices, tips, etc.? (Related to help documentation)*

H_0: The interaction among age, gender and occupation does not affect the SQ18

H_1: The interaction among age, gender and occupation affects the SQ18

Between-Subjects Factors		
		N
SQ1_Age	18 - 25	105
	26 - 35	236
	36 - 45	31
	Over 45	16
SQ2_Gender	Female	99
	Male	287
	Prefer not to say	2
SQ5_Occupation	Experienced IT worker	311
	Tertiary IT learner	77

Table 233 Age*Gender*Occupation Factors for SQ 18

Tests of Between-Subjects Effects						
Dependent Variable:	**SQ18**					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	21.161[a]	16	1.323	2.571	.001	.100
Intercept	68.162	1	68.162	132.502	.000	.263
SQ1_Age	4.107	3	1.369	2.661	.048	.021
SQ2_Gender	1.274	2	.637	1.239	.291	.007
SQ5_Occupation	2.080	1	2.080	4.044	.045	.011
SQ1_Age * SQ2_Gender	.971	3	.324	.629	.597	.005
SQ1_Age * SQ5_Occupation	.525	3	.175	.340	.796	.003
SQ2_Gender * SQ5_Occupation	.001	1	.001	.002	.966	.000
SQ1_Age * SQ2_Gender * SQ5_Occupation	1.469	2	.734	1.427	.241	.008
Error	190.850	371	.514			
Total	958.000	388				
Corrected Total	212.010	387				

a. R Squared = .100 (Adjusted R Squared = .061)

Table 234 ANOVA Tests of Between-Subjects Effects for Age*Gender*Occupation Factors and SQ 18

According to Table 234, the p value is .241, which is greater than .05. Therefore, there is not a statistically significant three-way interaction between age, gender and occupation with SQ 18.

*Age*Gender*Occupation: SQ 19 Does it have free version/free trial? (Related to pricing package)*

H_0: The interaction among age, gender and occupation does not affect the SQ19

H_1: The interaction among age, gender and occupation affects the SQ19

Between-Subjects Factors		
		N
SQ1_Age	18 - 25	105
	26 - 35	236
	36 - 45	31
	Over 45	16
SQ2_Gender	Female	99
	Male	287
	Prefer not to say	2
SQ5_Occupation	Experienced IT worker	311
	Tertiary IT learner	77

Table 235 Age*Gender*Occupation Factors for SQ 19

Dependent Variable:	**SQ19**					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	15.980[a]	16	.999	2.566	.001	.100
Intercept	47.886	1	47.886	123.031	.000	.249
SQ1_Age	10.801	3	3.600	9.251	.000	.070
SQ2_Gender	.796	2	.398	1.023	.361	.005
SQ5_Occupation	1.810	1	1.810	4.650	.032	.012
SQ1_Age * SQ2_Gender	2.555	3	.852	2.188	.089	.017
SQ1_Age * SQ5_Occupation	2.893	3	.964	2.477	.061	.020
SQ2_Gender * SQ5_Occupation	.640	1	.640	1.645	.200	.004
SQ1_Age * SQ2_Gender * SQ5_Occupation	.216	2	.108	.277	.758	.001
Error	144.399	371	.389			
Total	797.000	388				
Corrected Total	160.379	387				
a. R Squared = .100 (Adjusted R Squared = .061)						

Table 236 ANOVA Tests of Between-Subjects Effects for Age*Gender*Occupation Factors and SQ 19

According to Table 236, the p value is .758, which is greater than .05. Therefore, there is not a statistically significant three-way interaction between age, gender and occupation with SQ 19.

*Age*Gender*Occupation: SQ 20 Are the available licensing options clear and transparent? (Related to pricing package)*

H_0: The interaction among age, gender and occupation does not affect the SQ20

H_1: The interaction among age, gender and occupation affects the SQ20

Between-Subjects Factors		
		N
SQ1_Age	18 - 25	105
	26 - 35	236
	36 - 45	31
	Over 45	16
SQ2_Gender	Female	99
	Male	287
	Prefer not to say	2
SQ5_Occupation	Experienced IT worker	311
	Tertiary IT learner	77

Table 237 Age*Gender*Occupation Factors for SQ 20

Dependent Variable: SQ20						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	22.694[a]	16	1.418	2.649	.001	.103
Intercept	57.031	1	57.031	106.532	.000	.223
SQ1_Age	2.725	3	.908	1.697	.167	.014
SQ2_Gender	1.320	2	.660	1.233	.293	.007
SQ5_Occupation	.397	1	.397	.742	.390	.002
SQ1_Age * SQ2_Gender	3.257	3	1.086	2.028	.110	.016
SQ1_Age * SQ5_Occupation	3.007	3	1.002	1.872	.134	.015
SQ2_Gender * SQ5_Occupation	3.586	1	3.586	6.698	.010	.018
SQ1_Age * SQ2_Gender * SQ5_Occupation	8.932	2	4.466	8.342	.000	.043
Error	198.613	371	.535			
Total	959.000	388				
Corrected Total	221.307	387				
a. R Squared = .103 (Adjusted R Squared = .064)						

Table 238 ANOVA Tests of Between-Subjects Effects for Age*Gender*Occupation Factors and SQ 20

According to Table 238, the p value is .000, which is less than .05. Therefore, there is a statistically significant three-way interaction between age, gender and occupation with SQ 20.

*Age*Gender*Occupation: SQ 21 Is the pricing model for the software easy to understand? (Related to pricing package)*

H_0: The interaction among age, gender and occupation does not affect the SQ21

H_1: The interaction among age, gender and occupation affects the SQ21

Between-Subjects Factors		
		N
SQ1_Age	18 - 25	105
	26 - 35	236
	36 - 45	31
	Over 45	16
SQ2_Gender	Female	99
	Male	287
	Prefer not to say	2
SQ5_Occupation	Experienced IT worker	311
	Tertiary IT learner	77

Table 239 Age*Gender*Occupation Factors for SQ 21

Dependent Variable:	**SQ21**					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	17.855[a]	16	1.116	1.675	.049	.067
Intercept	54.513	1	54.513	81.835	.000	.181
SQ1_Age	8.865	3	2.955	4.436	.004	.035
SQ2_Gender	2.385	2	1.192	1.790	.168	.010
SQ5_Occupation	.001	1	.001	.002	.966	.000
SQ1_Age * SQ2_Gender	1.189	3	.396	.595	.619	.005
SQ1_Age * SQ5_Occupation	5.232	3	1.744	2.618	.051	.021
SQ2_Gender * SQ5_Occupation	.149	1	.149	.224	.636	.001
SQ1_Age * SQ2_Gender * SQ5_Occupation	.955	2	.477	.716	.489	.004
Error	247.134	371	.666			
Total	1144.000	388				
Corrected Total	264.990	387				
a. R Squared = .067 (Adjusted R Squared = .027)						

Table 240 ANOVA Tests of Between-Subjects Effects for Age*Gender*Occupation Factors and SQ 21

According to Table 240, the p value is .489, which is greater than .05. Therefore, there is not a statistically significant three-way interaction between age, gender and occupation with SQ 21.

*Age*Gender*Occupation: SQ22 Is the pricing model for the software flexible and scalable? (Related to pricing package)*

H_0: The interaction among age, gender and occupation does not affect the SQ22

H_1: The interaction among age, gender and occupation affects the SQ22

Between-Subjects Factors		
		N
SQ1_Age	18 - 25	105
	26 - 35	236
	36 - 45	31
	Over 45	16
SQ2_Gender	Female	99
	Male	287
	Prefer not to say	2
SQ5_Occupation	Experienced IT worker	311
	Tertiary IT learner	77

Table 241 Age*Gender*Occupation Factors for SQ 22

Dependent Variable:	**SQ22**					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	18.342[a]	16	1.146	1.475	.106	.060
Intercept	58.458	1	58.458	75.232	.000	.169
SQ1_Age	6.416	3	2.139	2.752	.042	.022
SQ2_Gender	2.750	2	1.375	1.769	.172	.009
SQ5_Occupation	.069	1	.069	.089	.765	.000
SQ1_Age * SQ2_Gender	1.682	3	.561	.722	.540	.006
SQ1_Age * SQ5_Occupation	5.571	3	1.857	2.390	.068	.019
SQ2_Gender * SQ5_Occupation	.080	1	.080	.104	.748	.000
SQ1_Age * SQ2_Gender * SQ5_Occupation	1.407	2	.704	.905	.405	.005
Error	288.284	371	.777			
Total	1359.000	388				
Corrected Total	306.626	387				
a. R Squared = .060 (Adjusted R Squared = .019)						

Table 242 ANOVA Tests of Between-Subjects Effects for Age*Gender*Occupation Factors and SQ 22

According to Table 242, the p value is .405, which is greater than .05. Therefore, there is not a statistically significant three-way interaction between age, gender and occupation with SQ 22.

*Age*Gender*Occupation: SQ 23 How often does it update the functionalities? (Related to updates of functionality)*

H_0: The interaction among age, gender and occupation does not affect the SQ23

H_1: The interaction among age, gender and occupation affects the SQ23

Between-Subjects Factors		
		N
SQ1_Age	18 - 25	105
	26 - 35	236
	36 - 45	31
	Over 45	16
SQ2_Gender	Female	99
	Male	287
	Prefer not to say	2
SQ5_Occupation	Experienced IT worker	311
	Tertiary IT learner	77

Table 243 Age*Gender*Occupation Factors for SQ 23

Dependent Variable:	**SQ23**					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	78.956[a]	16	4.935	1.724	.040	.069
Intercept	387.442	1	387.442	135.354	.000	.267
SQ1_Age	16.095	3	5.365	1.874	.133	.015
SQ2_Gender	4.703	2	2.351	.821	.441	.004
SQ5_Occupation	4.354	1	4.354	1.521	.218	.004
SQ1_Age * SQ2_Gender	14.831	3	4.944	1.727	.161	.014
SQ1_Age * SQ5_Occupation	1.035	3	.345	.121	.948	.001
SQ2_Gender * SQ5_Occupation	.666	1	.666	.233	.630	.001
SQ1_Age * SQ2_Gender * SQ5_Occupation	13.927	2	6.963	2.433	.089	.013
Error	1061.959	371	2.862			
Total	6463.000	388				
Corrected Total	1140.915	387				
a. R Squared = .069 (Adjusted R Squared = .029)						

Table 244 ANOVA Tests of Between-Subjects Effects for Age*Gender*Occupation Factors and SQ 23

According to Table 244, the p value is .089, which is greater than .05. Therefore, there is not a statistically significant three-way interaction between age, gender and occupation with SQ 23.

*Age*Gender*Occupation: SQ 24 How easy is it to use updated functionalities? (Related to update of functionality)*

H_0: The interaction among age, gender and occupation does not affect the SQ24

H_1: The interaction among age, gender and occupation affects the SQ24

Between-Subjects Factors		
		N
SQ1_Age	18 - 25	105
	26 - 35	236
	36 - 45	31
	Over 45	16
SQ2_Gender	Female	99
	Male	287
	Prefer not to say	2
SQ5_Occupation	Experienced IT worker	311
	Tertiary IT learner	77

Table 245 Age*Gender*Occupation Factors for SQ 24

Dependent Variable:	**SQ24**					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	15.874[a]	16	.992	1.680	.048	.068
Intercept	319.665	1	319.665	541.145	.000	.593
SQ1_Age	1.837	3	.612	1.037	.376	.008
SQ2_Gender	.873	2	.437	.739	.478	.004
SQ5_Occupation	3.521	1	3.521	5.960	.015	.016
SQ1_Age * SQ2_Gender	1.094	3	.365	.617	.604	.005
SQ1_Age * SQ5_Occupation	2.239	3	.746	1.264	.287	.010
SQ2_Gender * SQ5_Occupation	.542	1	.542	.917	.339	.002
SQ1_Age * SQ2_Gender * SQ5_Occupation	1.680	2	.840	1.422	.243	.008
Error	219.157	371	.591			
Total	6866.000	388				
Corrected Total	235.031	387				
a. R Squared = .068 (Adjusted R Squared = .027)						

Table 246 ANOVA Tests of Between-Subjects Effects for Age*Gender*Occupation Factors and SQ 24

According to Table 246, the p value is .243, which is greater than .05. Therefore, there is not a statistically significant three-way interaction between age, gender and occupation with SQ 24.

In conclusion, the interaction of age, gender and occupation affects SQ 13, 15, 16 and 20, which relates to data source connection, helping documentation, and pricing package. The interaction of these three-way does not affect other answers to questions.

4.2 Research Question and Hypothesis

	Literature Review	Hypothesis	Sub-research Questions	Survey Questions	Results
Main factors that influence IT professionals choose data visualization tools	2.2 User Interface	H1	Sub-research Question 1	SQ8	Yes 90.7%
				SQ9	Yes 87.9%
				SQ10	Yes 76.8%
				SQ11	Yes 81.7%
				SQ12	Yes 88.7%
	2.3 Data Source Connection	H2	Sub-research Question 2	SQ13	Yes 85.9%
				SQ14	Yes 80.5%
	2.4 Help Documentation and Application Support	H3	Sub-research Question 3	SQ15	Yes 68.3%
				SQ16	Yes 79.6%
				SQ17	Yes 71.4%
				SQ18	Yes 76.8%
	2.5 Pricing Package	H4	Sub-research Question 4	SQ19	Yes 82.5%
				SQ20	Yes 78.9%
				SQ21	Yes 71.1%
				SQ22	Yes 63.4%
	2.6 Updates of Functionalities	H5	Sub-research Question 5	SQ23	Partial
				SQ24	Yes 78.6%

Table 247 Link between Literature Review, Research Questions and Sub-research Questions, Hypothesis and Results

Table 247 represents the link between literature review, research questions and sub research questions, hypothesis and results. The participants answer the questions based on their frequently used data visualization tools. Most of them give positive feedback regarding their user interface, data source connection, help documentation,

pricing package, and updated functionality. According to the results of descriptive analysis, all the questions reach over 60% positive answers except for the survey question 23. SQ 23 relates to the frequency of update functionality, and 30.4% of participants choose “Not focus on it”, which ranked the second option. Therefore, H1, H2, H3, H4 are strongly supported, but H5 is partially supported.

Hypothesis	Description	Results
H1	User interface influences IT professionals to choose data visualization tools.	Supported
H2	Data source connection influences IT professionals to choose data visualization tools.	Supported
H3	Help documentation influences IT professionals to choose data visualization tools.	Supported
H4	Pricing package influences IT professionals to choose data visualization tools.	Supported
H5	Functionality updates influence IT professionals to choose data visualization tools.	Partial Supported

Table 248 Link between Hypothesis and Results

Table 248 shows the link between hypothesis and results. Although a third of IT participants do not pay attention to whether the data visualization software is updated or not, most people still answered the question, and 63.2% of people use software that has been updated within six months. 78.6% of people think that the updated features are good to use. Therefore, we can say that functionality updates are also a reason that can influence the choice of data visualization tools for IT professionals. Thus, the answers to sub-research questions have been shown in Table 249.

Sub-research Questions	Description	Results
RQ1	Does the user interface influence IT professionals to use data visualization tools?	Yes
RQ2	Does data source connection influence IT professionals to use data visualization tools?	Yes
RQ3	Does help documentation influence IT professionals to use data visualization tools?	Yes
RQ4	Does pricing package influence IT professionals to use data visualization tools?	Yes
RQ5	Does functionality updates influence IT professionals to use data visualization tools?	Yes

Table 249 Link between Sub-research Questions and Results

Thus, the answers to the main research question:

What factors that influence IT professionals to choose data visualization tools in China and New Zealand?

The influential factors for data visualization tools by IT professionals are user interface, data source connection, help documentation and application support, pricing package and functionality updates.

5. Discussion

In this chapter, the researcher interprets the significance of the findings and explains the new understanding of the questions. This chapter shows how the results relate to the researcher's research questions and hypothesis and the literature reviewed. The theoretical framework in Chapter 2 is used and modified for discussion in details and shown in Figure 83. Section 5.1 discusses the results of descriptive analysis, and Section 5.2 explains the results obtained by the Chi-square test. Section 5.3 represents the results of the three-way ANOVA analysis. The limitations of methodology and researcher are represented in the final section.

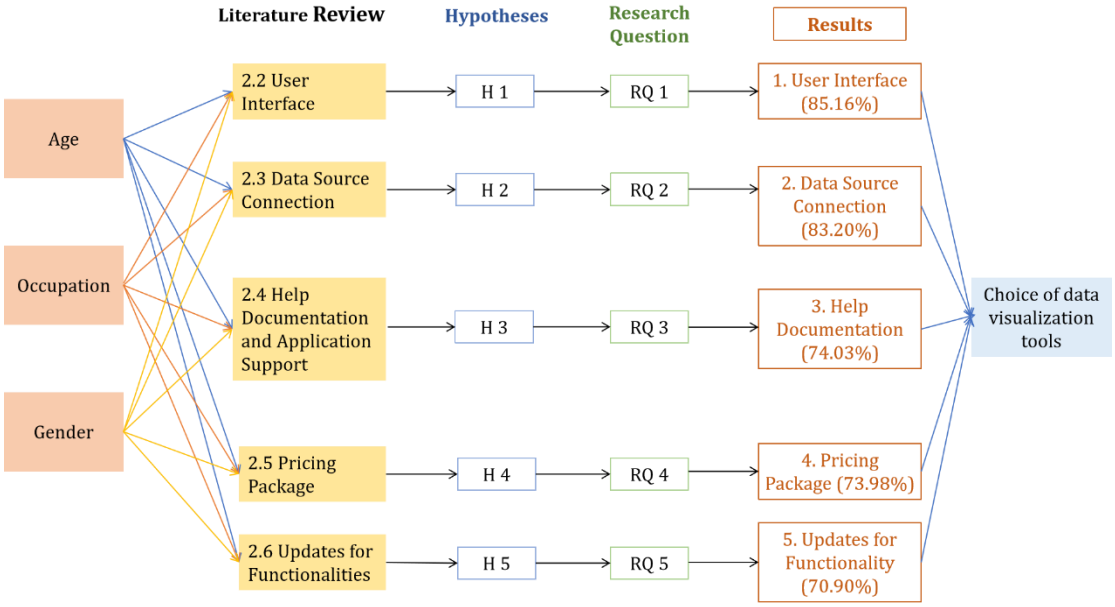

Figure 83 The Modified Theoretical Framework with Variables, Literature Review, Hypotheses, Research Questions and Results

5.1 Discussion on Descriptive Analysis

This part discusses a summary descriptive analysis of 388 valid responses. The researcher interprets the factors presented in the literature review that influence IT professional's choice of data visualization tools and assesses the weight of influence. The researcher discusses these factors based on the ranking of the agreement rates from highest to lowest. The agreement rate was calculated by adding up the

percentage of “Mostly satisfied” and “Completely satisfied” for each RQ corresponding to the SQ and dividing by the number of SQs.

5.1.1User Interface

Sub-RQ	Survey Question	Positive Rate	Average Positive Rate to Sub-RQ
RQ 1	SQ 8 How easy is it to install and configure the data visualization tools that you use?	90.70%	85.16%
	SQ 9 How easy is it to navigate through the data visualization tool that you use?	87.90%	
	SQ 10 How easy is it to find specific commands in the data visualization tools that you use?	76.80%	
	SQ 11 How easy is it to work with multiple tables in the data visualization tools that you use?	81.70%	
	SQ 12 How easy is it to visualize data into graphs in the data visualization tools that you use?	88.70%	

Table 250 Descriptive Analysis Results of User Interface

RQ1 Does the user interface influence IT professionals to use data visualization tools?

H1 User interface influences IT professionals to choose data visualization tools.

The survey questions associate with SQ8, SQ9, SQ10, SQ11 and SQ12.

Based on the results from the descriptive analysis, the user interface is the most important factor influencing IT professional’s choice of the data visualization tool. The results of the descriptive analysis are consistent with previous literature reviews that many users choose a particular platform because it is easy to use (Reina *et al.*, 2020). The user-friendly interface enables more people to use data visualization tools (Allen *et al.*, 2021).

Hence, the user interface significantly influences IT professionals’ choice of data visualization tools, which is shown in Figure 84.

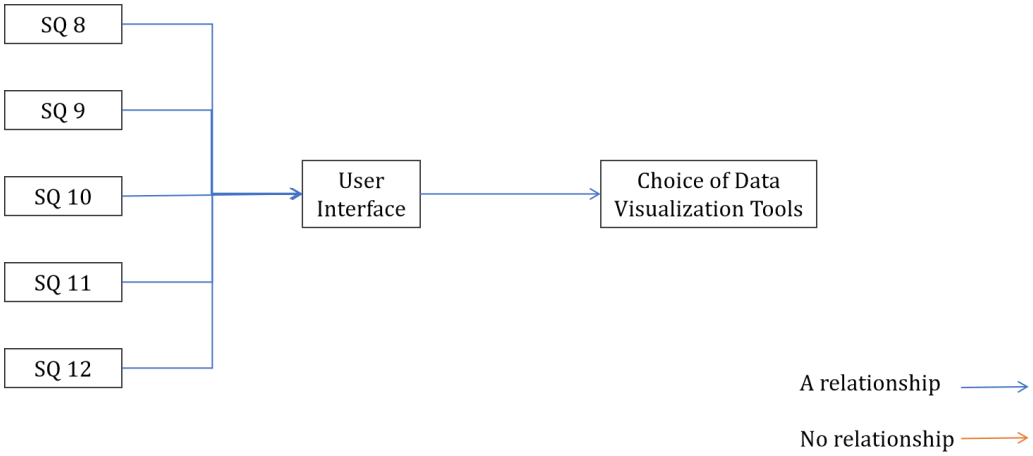

Figure 84 Descriptive Analysis Results for the Survey Question relates to User Interface and RQ

5.1.2 Data Source Connections

Sub-RQ	Survey Question	Positive Rate	Average Positive Rate to Sub-RQ
RQ 2	SQ 13 How easy is it extract/import data from data sources in the data visualization tools that you use?	85.90%	83.20%
	SQ 14 How easy is it to transform the data in the data visualization tools that you use?	80.50%	

Table 251 Descriptive Analysis Results of Data Source Connections

RQ2 Does the data source connection influence IT professionals to use data visualization tools?

H2 Data source connection influences IT professionals to choose data visualization tools.

The survey questions associate with SQ13 and SQ14.

83.2% of IT professionals believe that data source connection influences their choice of data visualization tools so that the data source connection is the second important factor. This result is also in line with what is reflected in the literature review that data source connection heavily influences people to choose data visualization software (El-Adaileh and Foster, 2019). Most data analysis techniques are adopted because the tool can easily connect to comprehensive data sources (Town and Thabtah, 2019).

Therefore, the results are shown in Figure 85: the data source connection has a

significant impact on the choice of data visualization tools by IT professionals.

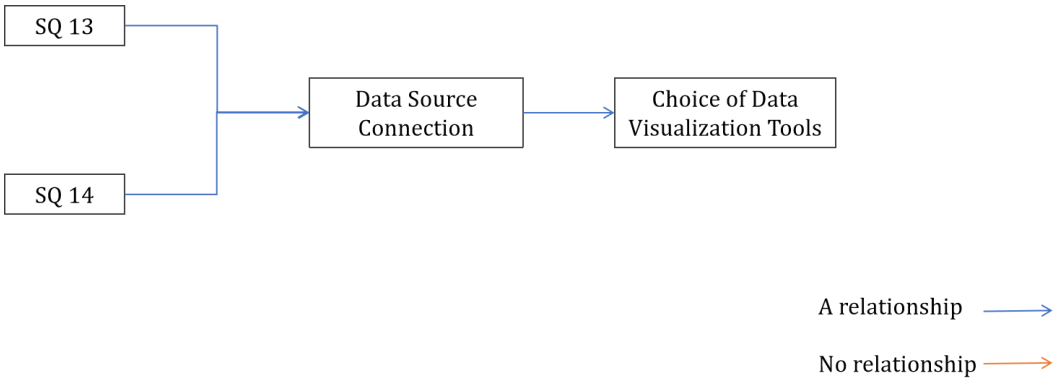

Figure 85 Descriptive Analysis Results for the Survey Question relates to Data Source Connection and RQ

5.1.3 Help Documentation and Application Support

Sub-RQ	Survey Question	Positive Rate	Average Positive Rate to Sub-RQ
RQ 3	SQ 15 Is training on the data visualization tools that you use available and accessible to all users?	68.30%	74.03%
	SQ 16 Are there self-paced tutorials on the data visualization tools that you use that user can access?	79.60%	
	SQ 17 Within the data visualization tools that you use, how easy is it for user to search and find answers to software-specific questions?	71.40%	
	SQ 18 Is there a robust and active user community accessible to share and learn best practices, tips, etc.?	86.80%	

Table 252 Descriptive Analysis Results of Help Documentation

RQ3 Does the help documentation influence IT professionals to use data visualization tools?

H3 Help documentation influences IT professionals to choose data visualization tools.

The survey questions associate with SQ15, SQ16, SQ17 and SQ18.

According to Reina *et al.* (2020), user manuals and tutorials are mandatory for most data visualization tools. Gowthami *et al.* (2017) also highlight the importance of self-paced video tutorials. Federer and Joubert (2018) suggest that user community is the

key to building a successful data visualization platform. Thus, the survey questions related to H3 cover training, self-paced tutorials, and the user community of data visualization tools. The conclusion reached is that 74.03% of IT professionals think that this factor affects their choice of data visualization tools, thus proving that help documentation and application support is the third most important factor. The conclusion has been shown in Figure 86.

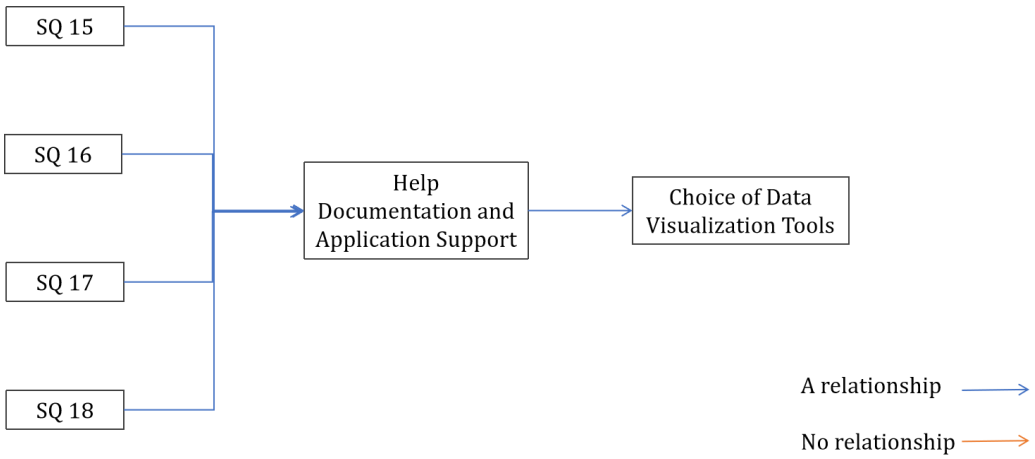

Figure 86 Descriptive Analysis Results for the Survey Question relates to Help Documentation and RQ

5.1.4 Pricing Package

Sub-RQ	Survey Question	Positive Rate	Average Positive Rate to Sub-RQ
RQ 4	SQ 19 Does it have free version/free trail?	82.50%	73.98%
	SQ 20 Are the available licensing options clear and transparent?	78.90%	
	SQ 21 Is the pricing model for the software easy to understand?	71.10%	
	SQ 22 Is the pricing model for the software flexible and scalable?	63.40%	

Table 253 Descriptive Analysis Results of Pricing Package

RQ4 Does the pricing package influence IT professionals to use data visualization tools?

H4 Pricing package influences IT professionals to choose data visualization tools.

The survey questions associate with SQ19, SQ20, SQ21 and SQ22.

The pricing package is the fourth vital factors that influence IT professionals' choice of data visualization tools. 73.98% of participants are satisfied with the pricing package of the data visualization tools they use. Of these, 82.50% of the participants are satisfied with the free version of the data visualization tool they are using. It can be concluded that the free version is an essential factor influencing the choice of users in the pricing package. Therefore, this finding aligns with the price model affecting the deployment of data visualization software by users (Gowthami *et al.*,2017).

Figure 87 has shown the results of descriptive analysis.

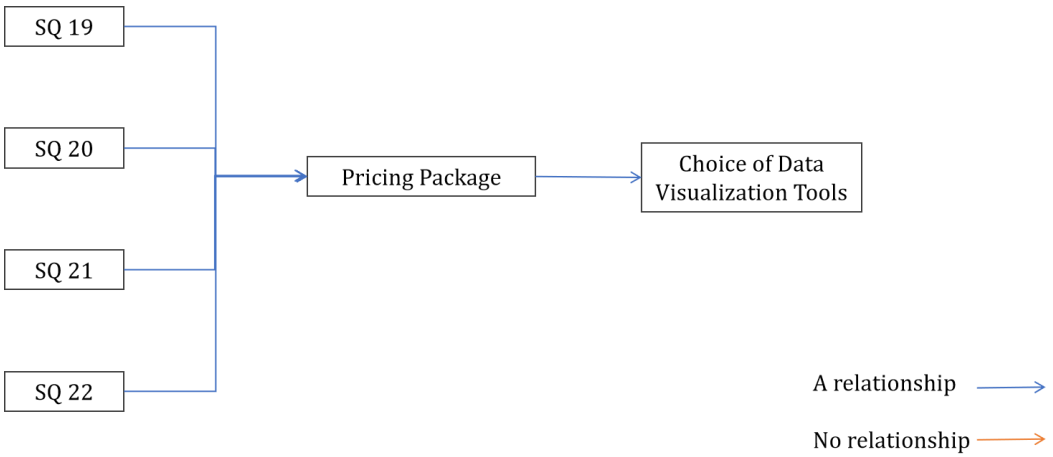

Figure 87 Descriptive Analysis Results for the Survey Question relates to Pricing Package and RQ

5.1.5 Update of Functionality

Sub-RQ	Survey Question	Positive Rate	Average Positive Rate to Sub-RQ
RQ 5	SQ 23 How often does it update the functionalities?	63.20%	70.90%
	SQ 24 How easy is it to use updated functionalities?	78.60%	

Table 254 Descriptive Analysis Results of Update of Functionality

RQ5 Does the functionality update influence IT professionals to use data visualization tools?

H5 Functionality update influences IT professionals to choose data visualization tools.

Update of functionality is the last factor that influences IT professionals to choose data visualization tools. Ju *et al.* (2021) show some room for improvement in the existing functionality of some visualization tools to better meet the needs of experts and non-experts. Jadidoleslam *et al.* (2020) also present that the progress for functions could improve user's experience. But very little literature evaluates this factor. So, the researcher provides two questions to reflect the aspect of updating the functionality of data visualization tools. In SQ23, 30.4% of people do not care if the data visualization tool they use is updated with new features, and this percentage reaches second. Therefore, the frequency of updates does not severely influence people's choice of visualization tools to use. However, the result of SQ24 shows 78.60% of IT professionals think the updated functions work well on the data visualization tools they use. Overall, 70.90% of participants believe that updates of functionality affect their choice of data visualization tools. The relationship between results and RQ has been shown in Figure 88.

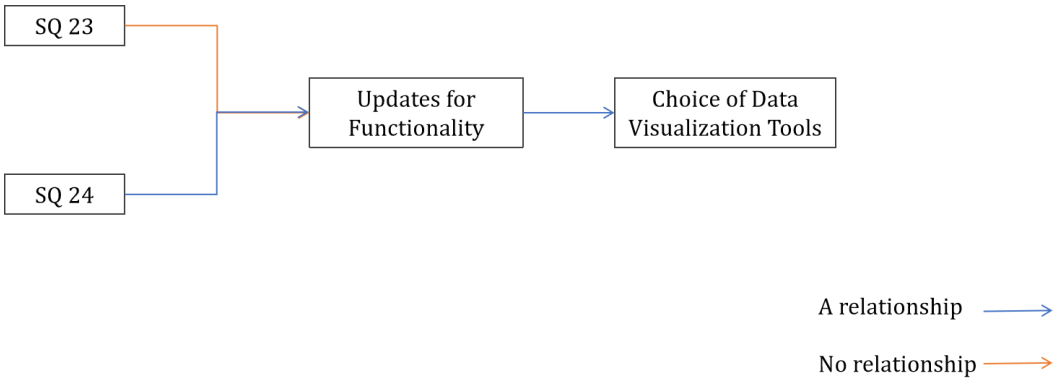

Figure 88 Descriptive Analysis Results for the Survey Question relates to Functionality Updates and RQ

5.2 Discussion on Chi-square Test

This part explains the interaction between independent variables and dependent variables. The results are obtained using Chi-square test. A chi-square test is conducted for each survey question regarding age, gender, and occupation to calculate p-values. With the help of p-values, the researcher determines whether the link between independent and dependent variables is independent or dependent. The data

for the Chi-square test is obtained from a statistically significant survey of 388 participants. The detailed results of each survey question have been displayed in Chapter 4. In this part, the Chi-square test results are summarized by each RQ, and the discussion proceeds sequentially from RQ1 to RQ5.

5.2.1 Interaction of Age/Gender/Occupation in RQ1 User Interface

SQ1 is the independent variable age, SQ2 is the independent variable gender, and SQ5 is the independent variable occupation. The survey questions relate to the user interface are SQ8, SQ9, SQ10, SQ11, SQ12. Figure 89 shows the interaction between moderating variables and independent variables according to the results of the Chi-square analysis. The significance of age, gender and occupation in terms of the user interface is discussed.

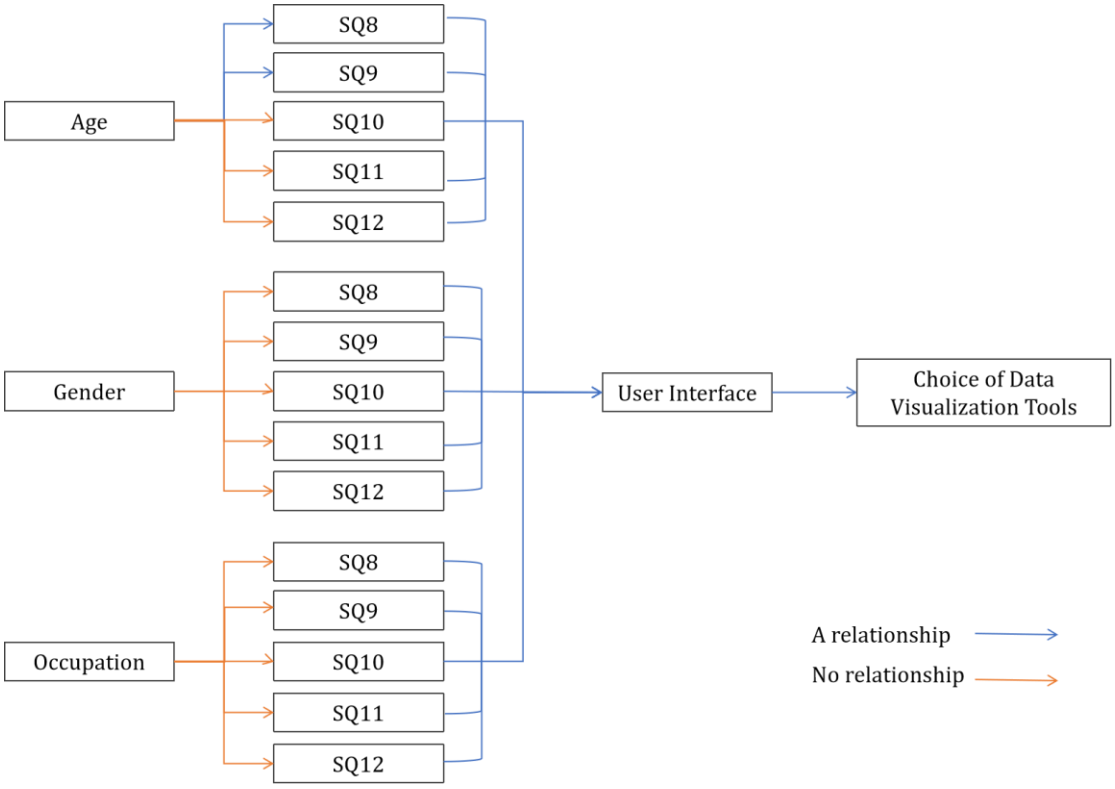

Figure 89 The Interaction between Age, Gender, Occupation and RQ1 User Interface

RQ1 Does the user interface influence IT professionals to use data visualization tools?

H1 User interface influences IT professionals to choose data visualization tools.

SQ8 relates to the installation and configuration of data visualization tools, SQ9 relates to navigation, SQ10 relates to specific commands, SQ11 relates to work with multiple tables, and SQ12 relates to visualizing data into graphs.

According to Figure 89, there is an association between age and SQ8, age and SQ9. Others are independent of each other.

5.2.2 Interaction of Age/Gender/Occupation in RQ2 Data Source Connection

SQ1 is the independent variable age, SQ2 is the independent variable gender, and SQ5 is the independent variable occupation. The survey questions relate to data source connection are SQ13, SQ14.

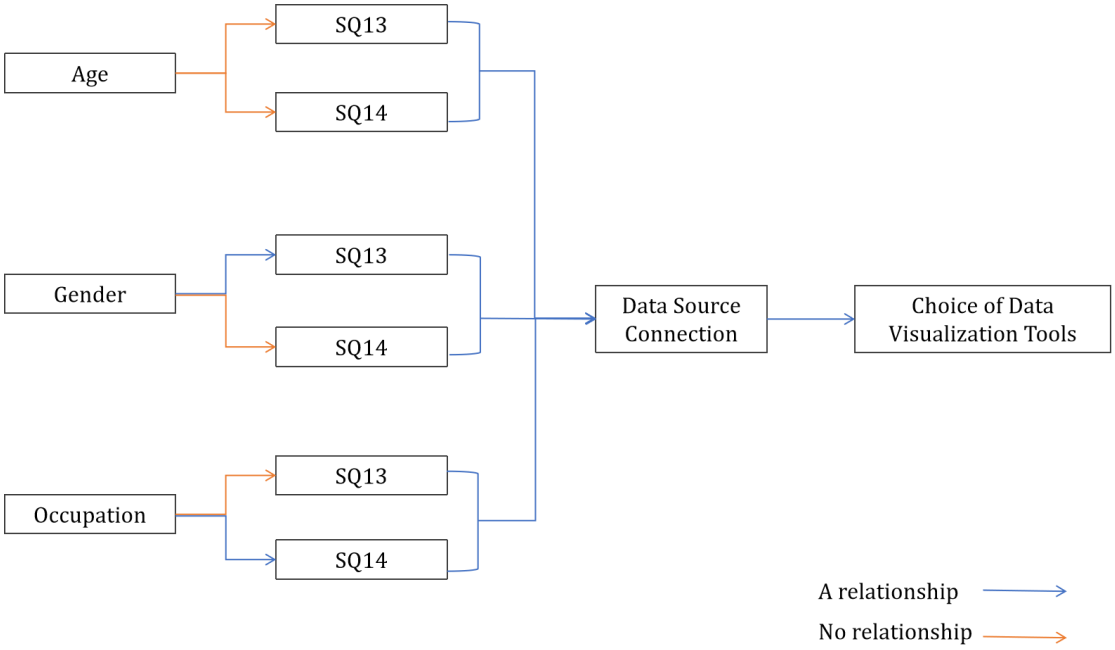

Figure 90 The Interaction between Age, Gender, Occupation and RQ2 Data Source Connection

RQ2 Does the data source connection influence IT professionals to use data visualization tools?

H2 Data source connection influences IT professionals to choose data visualization tools.

SQ13 relates to extracting/importing data from data sources, and SQ14 refers to data transformation.

According to Figure 90, there is a relationship between gender and SQ 13, occupation and SQ14. Others are independent of each other.

5.2.3 Interaction of Age/Gender/Occupation in RQ3 Help Documentation

SQ1 is the independent variable age, SQ2 is the independent variable gender, and SQ5 is the independent variable occupation. The survey questions relate to help documentation and application support are SQ15, SQ16, SQ17, SQ18.

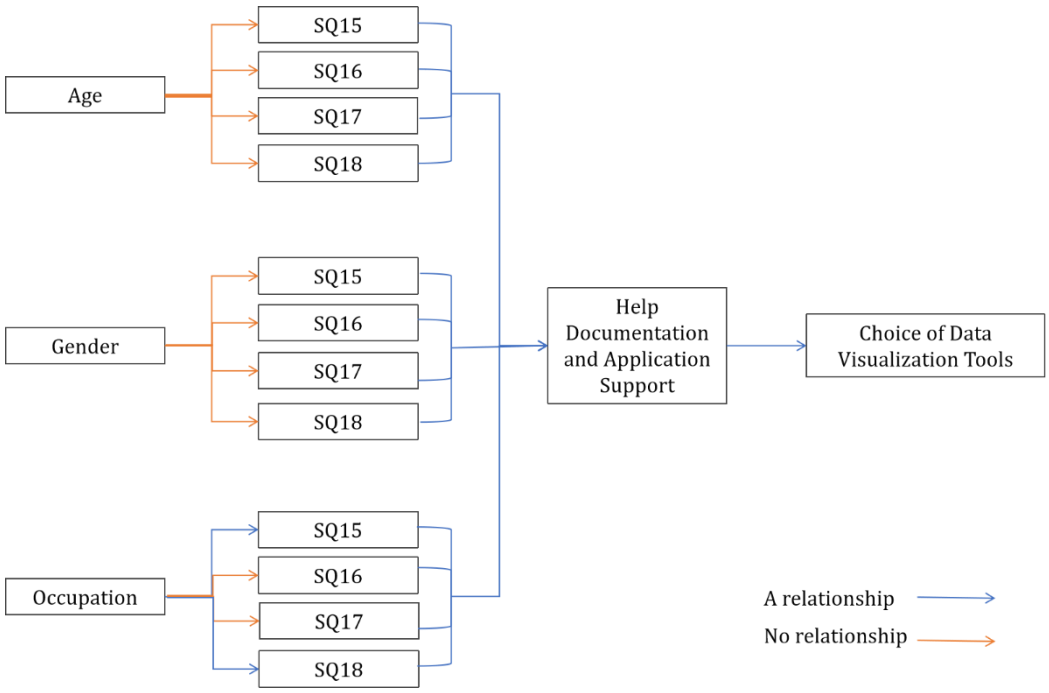

Figure 91 The Interaction between Age, Gender, Occupation and RQ3 Help Documentation

RQ3 Does the help documentation influence IT professionals to use data visualization tools?

H3 Help documentation influences IT professionals to choose data visualization tools.

SQ15 is about available training, SQ16 relates to self-paced tutorials, SQ17 relates to finding answers to software specific questions, SQ18 relates to the active user community.

Figure 91 indicates that there is a link between occupation and SQ15, occupation and SQ18. Others are independent of each other.

5.2.4 Interaction of Age/Gender/Occupation in RQ4 Pricing Package

SQ1 is the independent variable age, SQ2 is the independent variable gender, and SQ5 is the independent variable occupation. The survey questions relate to pricing package are SQ19, SQ20, SQ21, SQ22.

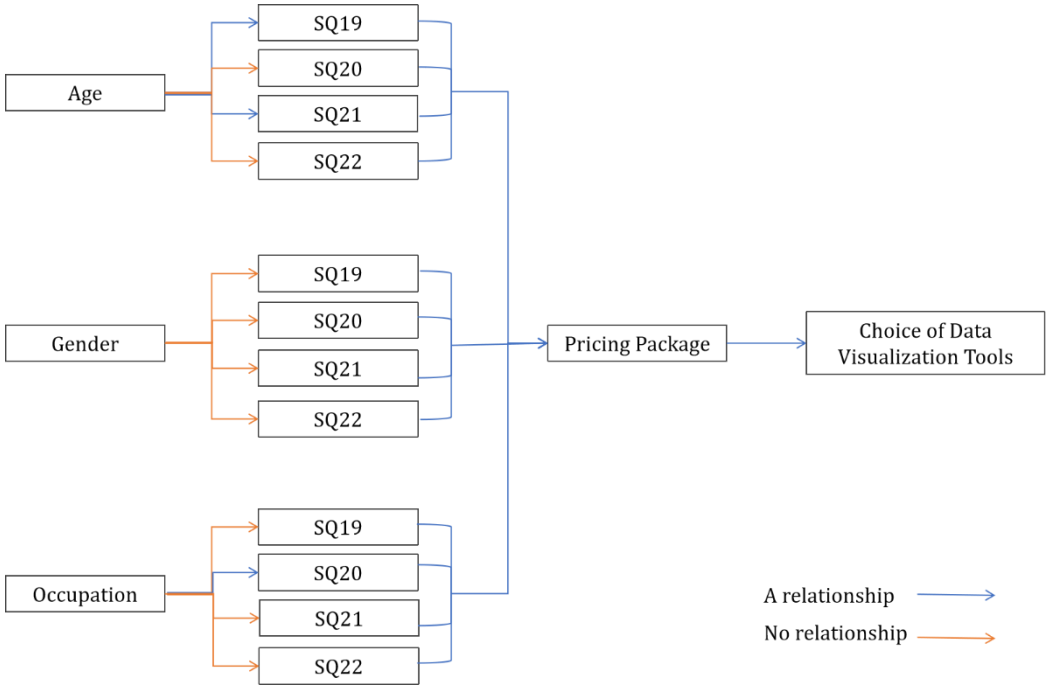

Figure 92 The Interaction between Age, Gender, Occupation and RQ4 Pricing Package

RQ4 Does the pricing package influence IT professionals to use data visualization tools?

H4 Pricing package influences IT professionals to choose data visualization tools.

SQ19 relates to the free version of data visualization tools, SQ20 relates to available licensing options, SQ21 and SQ22 relate to the price model.

According to Figure 92, there is an association between age and SQ19, age and SQ21, occupation and SQ20. Others are independent of each other.

5.2.5 Interaction of Age/Gender/Occupation in RQ5 Updates for Functionality

SQ1 is the independent variable age, SQ2 is the independent variable gender, and

SQ5 is the independent variable occupation. The survey questions relate to updates for functionality are SQ23, SQ24.

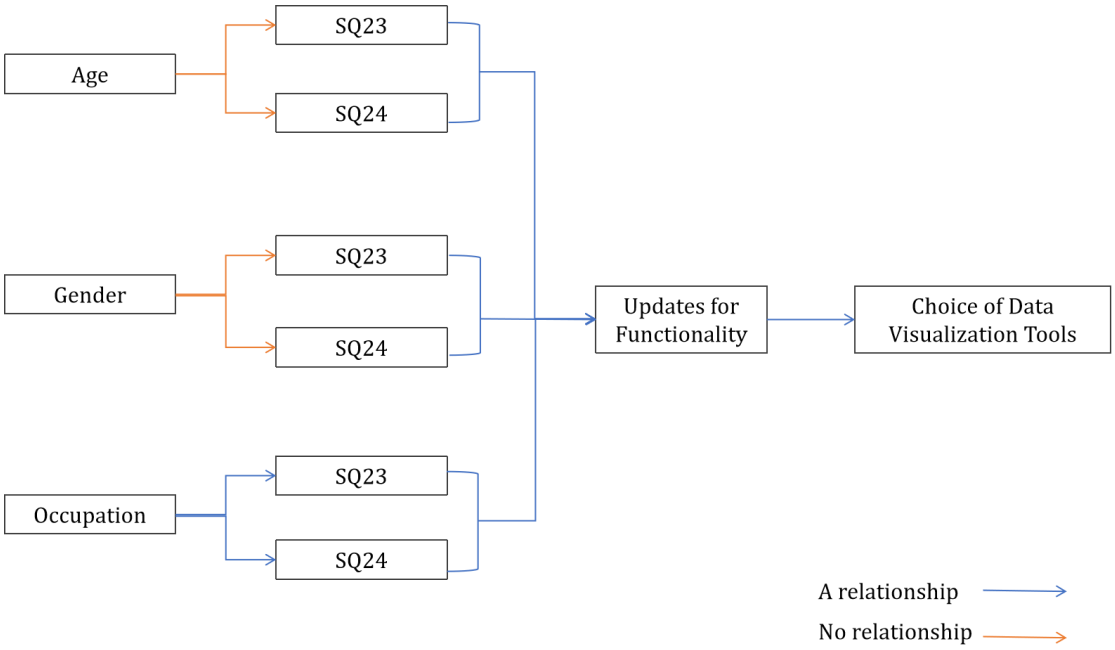

Figure 93 The Interaction between Age, Gender, Occupation and RQ5 Updates for Functionality

RQ5 Does the functionality update influence IT professionals to use data visualization tools?

H5 Functionality update influences IT professionals to choose data visualization tools.

SQ23 relates to the frequency of functions updates. SQ24 is about whether the updated functionality works well.

According to Figure 93, there is a relationship between occupation and functionality updates, but age and gender have no ties with functionality updates.

5.2.6 The Summary of Relationship of Age/Gender/Occupation in RQs

The summaries of Chi-square test Age & RQs, Gender & RQs, Occupation & RQs have been presented in the Table 255, 256 and 257.

Independent Variable	Sub-research Questions	Survey Questions	Chi-square Test Results
Age	RQ1 User Interface	SQ 8 How easy is it to install and configure the data visualization tools that you use?	H_1
		SQ 9 How easy is it to navigate through the data visualization tool that you use?	H_1
		SQ 10 How easy is it to find specific commands in the data visualization tools that you use?	H_0
		SQ 11 How easy is it to work with multiple tables in the data visualization tools that you use?	H_0
		SQ 12 How easy is it to visualize data into graphs in the data visualization tools that you use?	H_0
	RQ2 Data Source Connection	SQ 13 How easy is it extract/import data from data sources in the data visualization tools that you use?	H_0
		SQ 14 How easy is it to transform the data in the data visualization tools that you use?	H_0
	RQ3 Help Documentation and Application Support	SQ 15 Is training on the data visualization tools that you use available and accessible to all users?	H_0
		SQ 16 Are there self-paced tutorials on the data visualization tools that you use that user can access?	H_0
		SQ 17 Within the data visualization tools that you use, how easy is it for user to search and find answers to software-specific questions?	H_0
		SQ 18 Is there a robust and active user community accessible to share and learn best practices, tips, etc.?	H_0
	RQ4 Pricing Package	SQ 19 Does it have free version/free trail?	H_1
		SQ 20 Are the available licensing options clear and transparent?	H_0
		SQ 21 Is the pricing model for the software easy to understand?	H_1
		SQ 22 Is the pricing model for the software flexible and scalable?	H_0
	RQ5 Updates of Functionality	SQ 23 How often does it update the functionalities?	H_0
		SQ 24 How easy is it to use updated functionalities?	H_0

Table 255 The Summary of Chi-square Test Age & RQs

From Table 255, Age and RQ1 (user interface), Age and RQ4 (pricing package) have a partial relationship. However, Age is not associated with RQ2 (data source connection), RQ3 (help documentation) and RQ5 (updates of functionality).

Independent Variable	Sub-research Questions	Survey Questions	Chi-square Test Results
Gender	RQ1 User Interface	SQ 8 How easy is it to install and configure the data visualization tools that you use?	H_0
		SQ 9 How easy is it to navigate through the data visualization tool that you use?	H_0
		SQ 10 How easy is it to find specific commands in the data visualization tools that you use?	H_0
		SQ 11 How easy is it to work with multiple tables in the data visualization tools that you use?	H_0
		SQ 12 How easy is it to visualize data into graphs in the data visualization tools that you use?	H_0
	RQ2 Data Source Connection	SQ 13 How easy is it extract/import data from data sources in the data visualization tools that you use?	H_1
		SQ 14 How easy is it to transform the data in the data visualization tools that you use?	H_0
	RQ3 Help Documentation and Application Support	SQ 15 Is training on the data visualization tools that you use available and accessible to all users?	H_0
		SQ 16 Are there self-paced tutorials on the data visualization tools that you use that user can access?	H_0
		SQ 17 Within the data visualization tools that you use, how easy is it for user to search and find answers to software-specific questions?	H_0
		SQ 18 Is there a robust and active user community accessible to share and learn best practices, tips, etc.?	H_0
	RQ4 Pricing Package	SQ 19 Does it have free version/free trail?	H_0
		SQ 20 Are the available licensing options clear and transparent?	H_0
		SQ 21 Is the pricing model for the software easy to understand?	H_0

		SQ 22 Is the pricing model for the software flexible and scalable?	H_0
	RQ5 Updates of Functionality	SQ 23 How often does it update the functionalities?	H_0
		SQ 24 How easy is it to use updated functionalities?	H_0

Table 256 The Summary of Chi-square Test Gender & RQs

From Table 256, Gender has a partial relationship with RQ2 (data source connection). There is no relationship between Gender and other RQs.

Independent Variable	Sub-research Questions	Survey Questions	Chi-square Test Results
Occupation	RQ1 User Interface	SQ 8 How easy is it to install and configure the data visualization tools that you use?	H_0
		SQ 9 How easy is it to navigate through the data visualization tool that you use?	H_0
		SQ 10 How easy is it to find specific commands in the data visualization tools that you use?	H_0
		SQ 11 How easy is it to work with multiple tables in the data visualization tools that you use?	H_0
		SQ 12 How easy is it to visualize data into graphs in the data visualization tools that you use?	H_0
	RQ2 Data Source Connection	SQ 13 How easy is it extract/import data from data sources in the data visualization tools that you use?	H_0
		SQ 14 How easy is it to transform the data in the data visualization tools that you use?	H_1
	RQ3 Help Documentation and Application Support	SQ 15 Is training on the data visualization tools that you use available and accessible to all users?	H_1
		SQ 16 Are there self-paced tutorials on the data visualization tools that you use that user can access?	H_0
		SQ 17 Within the data visualization tools that you use, how easy is it for user to search and find answers to software-specific questions?	H_0
		SQ 18 Is there a robust and active user community accessible to share and learn best practices, tips, etc.?	H_1

	RQ4 Pricing Package	SQ 19 Does it have free version/free trail?	H_0
		SQ 20 Are the available licensing options clear and transparent?	H_1
		SQ 21 Is the pricing model for the software easy to understand?	H_0
		SQ 22 Is the pricing model for the software flexible and scalable?	H_0
	RQ5 Updates of Functionality	SQ 23 How often does it update the functionalities?	H_1
		SQ 24 How easy is it to use updated functionalities?	H_1

Table 257 The Summary of Chi-square Test Occupation & RQs

According to Table 257, there is a relationship between Occupation and RQ5 (updates of functionality). Occupation has a partial association with RQ2 (data source connection), RQ3 (help documentation) and RQ4 (pricing package). There is no relationship between Occupation and RQ1 (user interface).

5.3 Discussion on Three-way ANOVA Analysis

This part examines the summarized results of three-way ANOVA test for each research question. The data are obtained from 388 participants, the researcher conduct analysis using SPSS, and the results are presented in figures. ANOVA tests are conducted for each survey question regarding age*gender*occupation to calculate P-values. The interaction between age*gender*occupation and each survey question is discussed with the derived P-values' help.

5.3.1 Interaction of Age*Gender*Occupation and RQ1 User Interface

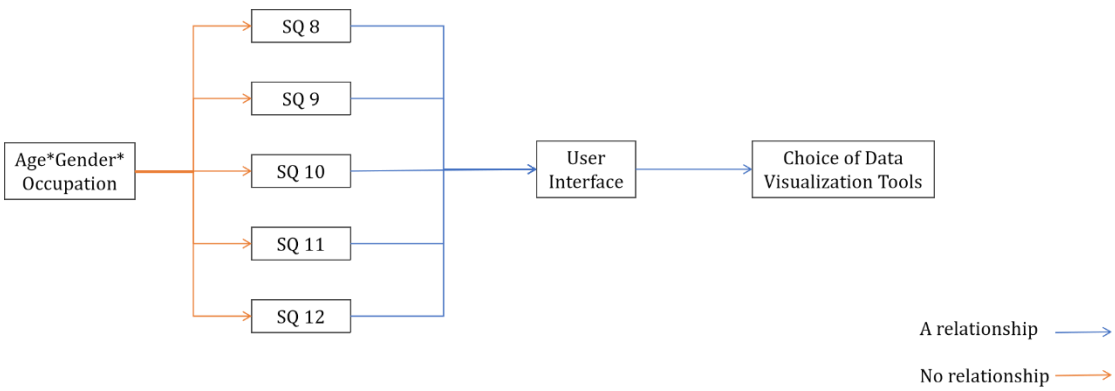

Figure 94 The Interaction between Age*Gender*Occupation and RQ1 User Interface

RQ1 Does the user interface influence IT professionals to use data visualization tools?

H1 User interface influences IT professionals to choose data visualization tools.

SQ8 relates to the installation and configuration of data visualization tools, SQ9 relates to navigation, SQ10 relates to specific commands, SQ11 relates to work with multiple tables, and SQ12 relates to visualizing data into graphs.

The results from the three-way ANOVA show that there is no relationship between the user interface of data visualization tools and different groups of IT participants. Figure 94 represents the results.

5.3.2 Interaction of Age*Gender*Occupation and RQ2 Data Source Connection

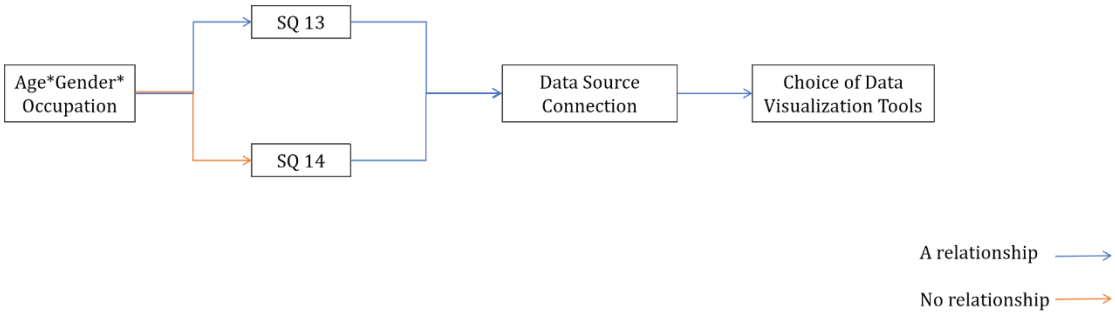

Figure 95 The Interaction between Age*Gender*Occupation and RQ2 Data Source Connection

RQ2 Does the data source connection influence IT professionals to use data visualization tools?

H2 Data source connection influences IT professionals to choose data visualization tools.

SQ13 relates to extracting/importing data from data sources, and SQ14 relates to data transformation.

The results from three-way ANOVA indicates that SQ13 connects to different groups of participants, but there is no association between SQ14 and diverse groups of

respondents. Figure 95 reveals the results. Therefore, there is a partial relationship between data source connection of data visualization tools and different groups of participants.

5.3.3 Interaction of Age*Gender*Occupation and RQ3 Help Documentation

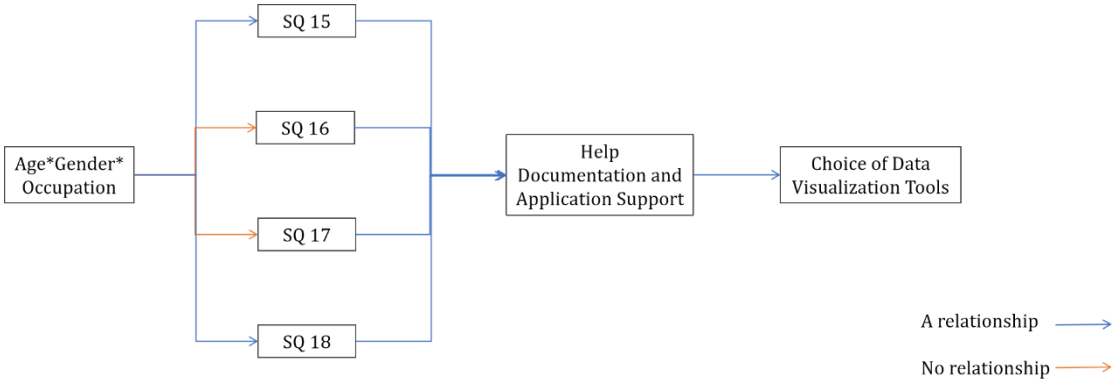

Figure 96 The Interaction between Age*Gender*Occupation and RQ3 Help Documentation

RQ3 Does the help documentation influence IT professionals to use data visualization tools?

H3 Help documentation influences IT professionals to choose data visualization tools.

SQ15 is about available training, SQ16 relates to self-paced tutorials, SQ17 relates to finding answers to software specific questions, SQ18 relates to the active user community.

Figure 96 describes the results from three-way ANOVA that there is a relationship between SQ 15 and different groups of IT professionals, SQ18 and different IT professionals. However, SQ16 and SQ17 have no association with diverse groups of participants. Thus, help documentation has a partial connection with various groups of participants.

5.3.4 Interaction of Age*Gender*Occupation and RQ4 Pricing Package

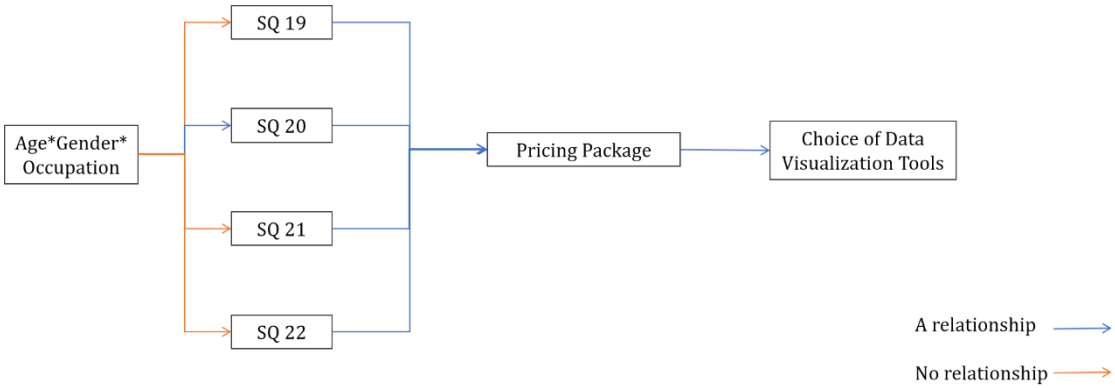

Figure 97 The Interaction between Age*Gender*Occupation and RQ4 Pricing Package

RQ4 Does the pricing package influence IT professionals to use data visualization tools?

H4 Pricing package influences IT professionals to choose data visualization tools.

SQ19 relates to the free version of data visualization tools, SQ20 relates to available licensing options, SQ21 and SQ22 relate to the price model.

According to the results of three-way ANOVA in Figure 97, SQ20 has a relationship with different groups of respondents, but other survey questions have no interaction with participants. Therefore, the pricing package has a partial interaction with diverse groups of IT participants.

5.3.5 Interaction of Age*Gender*Occupation and RQ5 Updates for Functionality

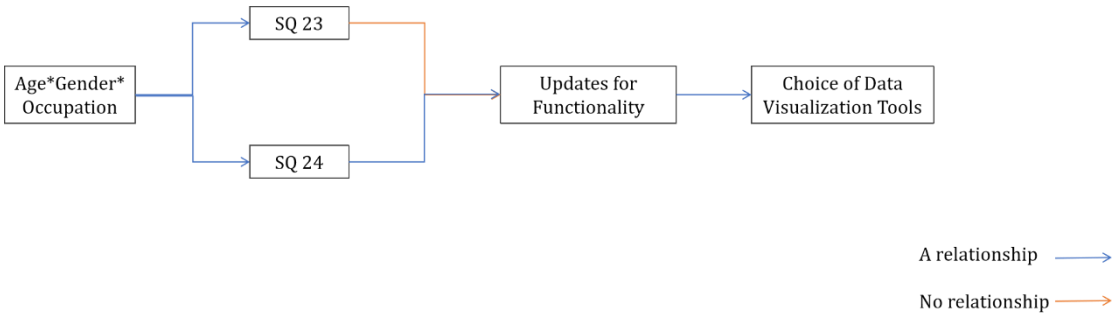

Figure 98 The Interaction between Age*Gender*Occupation and RQ5 Updates for Functionality

RQ5 Does the functionality update influence IT professionals to use data

visualization tools?

H5 Functionality update influences IT professionals to choose data visualization tools.

SQ23 relates to the frequency of functions updates. SQ24 is about whether the updated functionality works well.

From the results from three-way ANOVA, there is a relationship between functionality updates and different groups of respondents. Figure 98 displays the results.

5.3.6 The Summary of Relationship of Age*Gender*Occupation and RQs

The summary of three-way ANOVA test Age*Gender*Occupation & RQs, has been presented in the Table 258.

Independent Variable	Sub-research Questions	Survey Questions	Chi-square Test Results
Age* Gender* Occupation	RQ1 User Interface	SQ 8 How easy is it to install and configure the data visualization tools that you use?	H_0
		SQ 9 How easy is it to navigate through the data visualization tool that you use?	H_0
		SQ 10 How easy is it to find specific commands in the data visualization tools that you use?	H_0
		SQ 11 How easy is it to work with multiple tables in the data visualization tools that you use?	H_0
		SQ 12 How easy is it to visualize data into graphs in the data visualization tools that you use?	H_0
	RQ2 Data Source Connection	SQ 13 How easy is it extract/import data from data sources in the data visualization tools that you use?	H_1
		SQ 14 How easy is it to transform the data in the data visualization tools that you use?	H_0
	RQ3 Help Documentation and	SQ 15 Is training on the data visualization tools that you use available and accessible to all users?	H_1

	Application Support	SQ 16 Are there self-paced tutorials on the data visualization tools that you use that user can access?	H_1
		SQ 17 Within the data visualization tools that you use, how easy is it for user to search and find answers to software-specific questions?	H_0
		SQ 18 Is there a robust and active user community accessible to share and learn best practices, tips, etc.?	H_0
	RQ4 Pricing Package	SQ 19 Does it have free version/free trail?	H_0
		SQ 20 Are the available licensing options clear and transparent?	H_1
		SQ 21 Is the pricing model for the software easy to understand?	H_0
		SQ 22 Is the pricing model for the software flexible and scalable?	H_0
	RQ5 Updates of Functionality	SQ 23 How often does it update the functionalities?	H_0
		SQ 24 How easy is it to use updated functionalities?	H_0

Table 258 The Summary Three-way ANOVA Test Age*Gender*Occupation & RQs

From Table 258, the interactions among Age*Gender*Occupation partially affect RQ2 (data source connection), RQ3 (help documentation), and RQ4 (pricing package). However, the interactions among Age*Gender*Occupation does not affect RQ1 (user interface) and RQ5 (updates of functionality).

5.4 Limitation

There are two main categories of limitations within this research: issues from the methodology and issues with the researcher.

5.4.1 Methodological Limitations

Methodological limitations include issues of sample and selection, which are related to the techniques used to collect the data. In this research, the target sample is IT professionals from China and New Zealand. The researcher creates a Google form to collect the data, but Google has limited access unless the participants have a VPN in

China. Therefore, the researcher had a limited ability to obtain participants within the appropriate geographic area. In this case, the results may be affected by “sample bias”, although the researcher gets enough sampling. For future research, Qualtrics is a good choice of online survey software to reach respondents.

Another methodological limitation is the technique used to test the reliability of internal consistency. The researcher uses Cronbach’s Alpha to assess the internal consistency within this research. However, Cronbach’s Alpha is only for the ordinal scale. Only nine survey questions are tested, and other nominal scale data are not tested, which is limited to conducting a thorough reliability test. For future researchers, they can use R20 of Kuder-Richardson for nominal data.

5.4.2 Limitation of the Researcher

Time constraint is the limitation of the researcher. The time constraint influences the researcher to search for the most appropriate sampling in this research. The researcher mainly uses LinkedIn (international version) to invite people to carry out this survey. Before invitation, the researcher evaluates their backgrounds according to their profile, including work experience, educational level and majors. Therefore, the researcher may find more reliable IT professionals if there is enough time.

6. Conclusion

This chapter provides a critical analysis of the research procedure, disputes limitations and recommendations for future work. The researcher also summarizes the research process, presents the results and discusses the implications of the findings for the IT field.

6.1 Future Research

Data visualization is a compelling way to generate insights for data-driven decision

making. Data visualization software is becoming more common, and the industry is growing to focus more on the use of visualization tools. Therefore, understanding the factors that influence users to use data visualization tools is of great importance for the development of this industry.

The literature review in Chapter 2 provides five factors that need to be considered when choosing the proper data visualization tools: user interface, data source connection, help documentation, pricing package, and updates of functionality. This research evaluates the five factors mentioned above. It analyzes their importance in the perspectives of IT professionals. The results (in descending order of importance) are user interface, data source connection, help documentation, pricing package, and functionality updates. It can be considered that the purpose of the research has been largely achieved.

This research has been fully completed, including data collection and data analysis using three different analytical techniques, get results and discussion. However, the research still has some limitations, and these limitations may affect the study results.

Firstly, this research only uses a quantitative approach to gather the opinions of IT professionals. When carrying out the online survey, some survey questions may be answered haphazardly or with regular answers. Future research could use mixed methods (qualitative and quantitative) to identify more insights and challenges in data visualization software and avoid biased answers. Future research should also do a case study or interview IT professionals to discover more about the key factors and issues using data visualization platforms.

Secondly, sample and selection issues are related to the technology used to collect the data. The researcher creates a Google form to collect the data, but Google has limited access unless the participants have a VPN. In this case, the researcher had limited ability to obtain participants within China. Although the researchers were given an adequate sample, the results may have been influenced by “sample bias”. For future research, Qualtrics is a good option for online survey software to reach respondents.

Thirdly, the technique used to test internal consistency reliability is limited for conducting thorough reliability tests. The researcher uses Cronbach's Alpha to assess the internal consistency in this study. However, Cronbach's Alpha is only for ordinal scales, and other nominal scale data are not tested. For future researchers, they can use Kuder-Richardson's R20 to test nominal data.

6.2 Conclusion Remark

Face with complex and large-scale datasets, and data visualization tools need to deal with difficult situations. Still, users want a simple and straightforward user experience to solve complex data and get valuable information. Therefore, user-centred design (UCD) is a strong trend in data visualization tools, which needs to consider what problems the user is trying to solve and what possible obstacles they face. This research aims to identify the factors behind choosing data visualization tools. The target participants are IT professionals who can provide a deep insight into using data visualization software.

According to the literature review, this research examines and evaluates the weight of the following factors: user interface, data source connection, help documentation, pricing package and updates of functionality. The literature review helps to highlight the importance of each element and led to the formation of the research questions and hypotheses for this research project. This research employs post-positivist worldview and a quantitative approach. The researcher also discusses the sampling technique, data collection, and data analysis methods. In addition, the limitations of this study and future work are explained.

A total of 388 valid responses are collected in this survey. The number of responses reached a target participants number. The online survey is conducted on LinkedIn (international version). The researcher uses IBM's statistical analysis tool SPSS to analyze the answers to the research questions by applying descriptive analysis, Chi-square test, and three-way ANOVA.

Based on the previous studies and the analysis conducted in this research, the research questions are answered, and the hypothesis is verified. Overall, it can be seen that the factors that influence the use of visualization tools in the perspectives of IT professionals in China and New Zealand are (in descending order): user interface, data source connection, help documentation, pricing package and updates of functionality. The researcher could draw that conclusion, and the purpose of the research is achieved. The weighting of these five factors can be helpful for the design of data visualization tools to understand the users' intent and functional needs.

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Appendixes

Appendix A. Low Risk Human Ethics in Research Application Form

Wintec WAIKATO INSTITUTE OF TECHNOLOGY Te Kuratini o Waikato	Research and Postgraduate Office (RPGO) Human Ethics in Research Group (HERG)

LOW RISK HUMAN ETHICS IN RESEARCH APPLICATION FORM

Please refer to the Ethics Guidelines prior to completing this application.

The RPGO is located at the City Campus, D-Block (Offices D2.22 – D2.24), email

research@wintec.ac.nz or phone Megan Allardice on Ext. 3582 for more information.

Please see the last page of this document for detailed instructions for completing this form.

1.0	**PROJECT TITLE**
	The factors that influence IT professionals to use data visualization tools in China and New Zealand

2.0	**RESEARCHER(S)**	
2.1	Primary researcher's name	Xilei Liu
2.2	School//Centre/Unit	Centre for Information Technology
2.3	Contact Details (Telephone and E-mail)	Tel. 021 237 6868 Email: sophiask23@sina.cn xilliu01@student.wintec.ac.nz
2.4	Is this application a:	☒ Student Application ☐ Staff Application
2.5	If this is a student application, please provide the Module code here	INFO901
2.6	Is this project a staff application that utilises work partially or wholly undertaken by students who are not participants (e.g. data collection undertaken by a researcher's class)?	N/A
2.7	If so, please clearly describe what the role of these students is to be in this research, what the work will be used for	N/A

	explicitly (including any issues regarding authorship of research outputs such as journal articles), and what steps have been taken to ensure students are aware of this.	
2.8	Name of other Researcher(s) and positions. (If this is a student application please provide the name(s) of the project supervisor(s) and indicate that they are supervisors here.)	Dr Monjur Ahmed Dr Michael Bosu
2.9	Contact Details of other researchers and/or supervisors (Telephone and E-mail)	Email: monjur.ahmed@wintec.ac.nz Email: michael.bosu@wintec.ac.nz
2.10	Is this application:	☒ A new application ☐ A subsequent approval request following a significant change to an already approved application

3.0	**PROJECT TIMELINE**
	Projected start date for **data collection** *(once this ethics application is approved. Please note, projects can only begin once applications have been approved, regardless of the level of risk)*: March 2021 Projected end date: End of semester

4.0 PROJECT SUMMARY (please include your research purpose and objectives, methodology will be dealt with in Section 6)

This research paper outlines a research proposal regarding the factors that influence IT professionals to choose data visualization tools in China and New Zealand. The methodologies and methods of the research have been discussed, and the sampling size has been justified as well. This research will contribute to the evaluation of the current data visualization tools from IT professionals' perspectives, and improve the design of data visualization tools to satisfy the user's intents, leading a greater adoption.

5.0 PROJECT METHODOLOGY (including methods for data collection)

This research will conduct a quantitative approach to analyze the elements, which include user interface, data source connection, help documentation, pricing package and updates for functionalities. This research will adopt a statistically significant online survey with IT professionals which includes IT learners and experienced IT workers in China and New Zealand. With the unknown population size, a confidence interval of 5 and a confidence level of 95%, the sampling size of 384, which was calculated from https://www.surveysystem.com/sscalc.htm

6.0 CONSIDERATON OF ETHICAL ISSUES AND PROCESSES

Please describe below the process that you have undergone in order to discuss and analyze the ethical issues present in this project. (For example, who have you consulted in regards to ethical issues or in completing the screening questionnaire and this Low Risk application)

I have consulted with Dr Kay Fielden and all of the following ethical considerations are highlighted in this research:

- Risk of harm

The questions in the online survey are in general nature regarding five evaluation criteria of data visualization tools.

- Informed and voluntary consent

The participants above the age of 18 will be only accepted to participate in this research, and they will be fully informed of the purpose of the study before starting the online survey. Before beginning the online survey, the information page will be provided to show the purpose of the research, expected duration and procedures. Participants will be informed that if they complete and submit the survey, they will be deemed to have consented to the use of their anonymous data.

- Privacy and confidentiality

The online survey is anonymous and no confidential information is collected. Also, the information gained from the participants will not be available to the public.

- Deception

There is no deception of participants, including concealment and covert observations.

- Conflict of interest

There is no conflict of interest in the research.

- Procedural

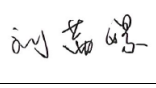
This research is no further ethical requirements or approval required from outside organizations. This research will not include Wintec staff or students.

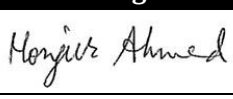
- Treaty of Waitangi and Māori participation

The Māori is not the primary participants in this research.

- Other cultural considerations

This research does not specifically target a particular ethnic group and does not raise any specific cultural issues as well.

Researcher(s) signature(s) (the name and signature of all researcher(s) are to be included):		
Name	**Signature**	**Date**
Xilei Liu		March 9, 2021

Primary Supervisor's signature (if this is a student application):		
Name	**Signature**	**Date**
Dr Monjur Ahmed		9 March 2021

Research Leader's signature:		
Name	**Signature**	**Date**
Dr Monjur Ahmed		9 March 2021

HERG Chairperson or delegated representative's signature (RPGO use only):		
Name	**Signature**	**Date**

COMPLETING THIS FORM

Please note: A low risk research project is one in which the nature of the potential/actual risk of harm to participants or the researcher is minimal and no more than is normally encountered in daily life. If, as a staff member, you are new to research or are in any doubt as to which application to submit, please consult with your Research Leader. If you are a student, your supervisor will be able to give you advice. If you are still in any doubt, don't hesitate to consult the RPGO.

Specific Instructions

- All questions are to be answered. Note the questions within require a mix of descriptions, yes/no answers and cross the box (**Double-click on check boxes with your mouse and select 'Checked' from the options under 'Default Value'**).
- Research Leaders need to review the information in this form and sign it off prior to application being made to the RPGO.
- Please forward one signed original copy to the RPGO, together with an electronic version to research@wintec.ac.nz.
- Low Risk Human Ethics in Research Applications also need to be accompanied by a copy of the Information Sheet, Consent Form, and any Questionnaires or Interview Schedules for consideration. If Questionnaires/ Schedules are not yet confirmed, please supply the latest draft.
- No questions are to be deleted, even those that you feel you are not required to answer.
- No part of the research requiring ethical approval should commence prior to approval being confirmed.
- Applicants will receive an official confirmation of submission via email from the RPGO once all conditions of this form have been completed.
- If you want to apply for an extension on a previously approved project, please contact the RPGO, as you will probably not need to submit a separate application.
- Applicants will be advised of the outcome of their application to the Human Ethics in Research Committee **no later than ten working days** after the completed and confirmed submission of this application.

HUMAN ETHICS IN RESEARCH LOW RISK APPL	
Research project title:	**The factors that influence IT professionals to use data visualization tools in China and New Zealand**
Name of primary researcher:	**Xilei Liu**

Attached please find (as applicable) in the order listed below	
Completed HERG Low Risk Application Form	☒ Yes ☐ No
Consent Form for participants	☐ Yes ☒ No
Information Sheet for participants	☒ Yes ☐ No
Copy of Focus Group Questions, Interview Schedule, or similar	☒ Yes ☐ No

Appendix B. An online survey: Questionnaire

I am Xilei Liu, studying Master of Applied Information Technology at Waikato Institute of Technology, New Zealand. This online survey will be conducted as a part of collecting data for my research project module.

The main purpose of this research is to identify the factors that influence IT professionals to choose data visualization tools. Based on your valuable responses, the results will contribute to the design of data visualization software to satisfy the user's intents.

Kindly provide the true answers to the questions that have been asked within the survey to the best of your awareness and practice on data visualization tools.

The questionnaire has total 24 questions and it will not take more than 10 minutes of your time to complete.

The data will be collected online and you can answer the survey easily.

The data collected will be stored in a secure area with limited access and the collected data will be disposed after the research is completed.

Participation in this survey is voluntary. By answering the questions of this survey, a participant is considered to have consented to take part in this survey.

You can withdraw yourself from the survey at any point without any penalty.

No personal and/or sensitive data will be collected in the survey and all the responses are recorded anonymously. Also, all the data collected will be treated as confidential data and will not be disclosed to any third-party person or organization for a commercial purpose.

Research results will be available upon request. Please supply your email address below if you wish to receive a copy of the research results.

For any further inquiries, please contact: xilliu01@student.wintec.ac.nz

Thank you for your valuable response and the time taken to fill this survey.

Name of Researcher/s: Xilei Liu

Contact Details: xilliu01@student.wintec.ac.nz

Date: ……

No.	Sample Questions	Answers
S1	What is your age group?	Under 18 18-25 26-35 36-45 Over 45
S2	What is your gender?	Male Female Prefer not to say
S3	What is your educational level?	Bachelor Degree Gradate Dip. Master Degree Postgraduate Dip. PhD Other
S4	Are you an IT professional?	Yes No
S5	What's your occupation?	Tertiary IT learner Experienced IT worker
S6	Do you use data visualization tools?	Yes No
S7	Which data visualization tools do you use frequently? (multiple choice questions)	Tableau Microsoft Power BI Fusion Charts Chart.js Qlikview Sisense Google Analytics Excel Other
S8	How easy is it to install and configure the data visualization tools that you use?	Completely dissatisfied Mostly dissatisfied Neutral Mostly satisfied Completely satisfied
S9	How easy is it to navigate through the data visualization tool you use?	Completely dissatisfied Mostly dissatisfied Neutral Mostly satisfied Completely satisfied
S10	How easy is it to find specific commands in the data visualization tools that you use?	Completely dissatisfied Mostly dissatisfied Neutral Mostly satisfied

		Completely satisfied
S11	How easy is it to work with multiple tables in the data visualization tools that you use?	Completely dissatisfied Mostly dissatisfied Neutral Mostly satisfied Completely satisfied
S12	How easy is it to visualize data into graphs in the data visualization tools that you use?	Completely dissatisfied Mostly dissatisfied Neutral Mostly satisfied Completely satisfied
S13	How easy is it extract/import data from data sources in the data visualization tools that you use?	Completely dissatisfied Mostly dissatisfied Neutral Mostly satisfied Completely satisfied
S14	How easy is it to transform the data in the data visualization tools that you use?	Completely dissatisfied Mostly dissatisfied Neutral Mostly satisfied Completely satisfied
S15	Is training on the data visualization tools that you use available and accessible to all users?	Yes No Neutral
S16	Are there self-paced tutorials on the data visualization tools that you use that user can access?	Yes No Neutral
S17	Within the data visualization tools that you use, how easy is it for user to search and find answers to software-specific questions?	Completely dissatisfied Mostly dissatisfied Neutral Mostly satisfied Completely satisfied
S18	Is there a robust and active user community accessible to share and learn best practices, tips, etc.?	Yes No Neutral
S19	Does it have free version/free trial?	Yes No Neutral
S20	Are the available licensing options clear and transparent?	Yes No Neutral
S21	Is the pricing model for the software easy to understand?	Yes No Neutral

S22	Is the pricing model for the software flexible and scalable?	Yes No Neutral
S23	How often does it update the functionalities?	Never Once a month Every three months Every six months Once a year Not focus on it
S24	How easy is it to use updated functionalities?	Completely dissatisfied Mostly dissatisfied Neutral Mostly satisfied Completely satisfied

Appendix C. Flow chart of the survey questions